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UNDERGROUND TO HARLEM.

After delays that have seemed endless, New York City is at last within sight of underground traction, and a road that will carry passengers to Harlem from City Hall, a distance of, say, seven miles in fifteen minutes, will be begun within a month. Two bids were made this week for the construction of the road, and one of them which names $35,000,000 for the work and the equipment has been accepted by the New York Rapid Transit Commissioners. This contractor also agrees to operate the road for the upset price or statutory requirement of interest equal to that paid by the city for its bonds issued to meet the cost, and 1 per cent. additional.

It may be some five years before this great work is complete and perfect, and some time must elapse in any event before the city can enjoy this increase to its transportation facilities. Hence we must all wait some time before learning whether the underground road pays. It is interesting to note that the bid accepted comes within the estimate of the Board. Of course the road is to be operated electrically, and if we assume that 20 per cent. of the outlay goes into electrical apparatus and auxiliaries, it would appear that $7,000,000 will presently have to be spent amongst electrical concerns, from this enterprise alone, which is but one of many transportation enterprises on the large scale to be electrified in the near future.

COMMUNICATION IN THE TRANSVAAL.

It is natural that with the continuance of the war in the Transvaal a good many of the land telegraph lines should be interrupted. The Boers can do little in communicating with the outside world, and the British can do little to exchange intelligence with the besieged places that were cut off in the first rush of Boer invasion. At such a time, the use of wireless methods will be attended with great importance and reports of their working will be awaited with great interest. Meanwhile it is curious to note that the British have resorted to the employment of carrier pigeons, and that the pigeon post between Ladysmith and Durban has worked very successfully. There are said to be no fewer than 1,000 homing pigeons on the books of the British navy. Between them and the etheric telegraph will now wage a struggle akin to that which ensued lately between the trolley and the mule.

ELECTRIC CURRENT SUPPLY IN LONDON.

Our English correspondent calls attention to the singular fact that in London recently the companies have been begging their customers to burn as little current as possible between the hours of four and six. In other words, demand has outrun capacity, and they are not longer able to take care of the peak of the load. This state of affairs has been impending a long time, and it might reasonably have been expected that preparations to avoid such a humiliating confession would be made. But the traditional Anglo-Saxon unreadiness which prefers to deal with a crisis after it has arisen rather than mitigate or prevent it by anticipatory measures, has in this case once more been demonstrated, so that we find the companies begging buyers of current to go away. Something of the same tendency has been manifested in English electrical manufacturing, which rather than increase its own plants, has preferred to see outsiders step in and put up competing shops on the largest scale. Evidently the

British do not, in business, go in for the headlong "frontal attacks" that distinguish their military campaigns.

But the present conditions in London cannot endure, and we are glad to learn on the best authority that steps are now being taken to increase the production of current. The idea is to employ the existing electric light stations as transforming plants, and to manufacture the current in bulk at new generating stations, some of which are now being erected in the suburbs of London. From an American standpoint, it would seem that this work could be greatly facilitated and the current cheapened by putting all of the plants into one system, under one management, as has been done in several of our large cities, but it is obvious that London is not ripe for any such movement, with its hodgepodge of public plants, private companies, varying authorities and different systems of distribution.

PACIFIC CABLE SCHEMES.

Considerable interest has been developed in the subject of Pacific cable plans since Capt. G. O. Squier, of the Signal Service, read his interesting paper before the American Institute of Electrical Engineers. In addition to the comments that have already appeared in these and other columns, we note the expert criticism of Mr. George G. Ward, general manager of the Commercial Cable Company, who complains that the Squier estimates do not provide for a duplicate cable, and which runs the annual total expenditure up to $1,525,000, not inclusive of the cost of operating the second cable. He adds: "It is evident, therefore, that the government would be required to invest about $25,000,000 capital, and also incur an annual expenditure of over $1,500,000, less the earnings from traffic, which would be comparatively small, to maintain and operate a Pacific cable system, and yet it would not reach Japan and China, for those countries are not likely to permit a United States government cable to be landed and operated unless backed by an American fleet. Certainly the United States government would not care to risk $25,000,000, or even $12,000,000, of property to be managed by Japanese and Chinese." We are inclined to think that our welcome in the Far East would be more cordial than Mr. Ward here admits, but his figures are certainly weighty and worth careful consideration.

Another aspect of the matter is presented, however, in the succinct article by "F. R. G. S.," which we print with map in this issue. Here is an alternative plan which undoubtedly looks well. We should like more definite data as to the cost and permanence of land lines in such high northern latitudes, but it is evident that definite lines of communication around that way are about to be set up, and the gold discoveries, of which Cape Nome even, may not be by any means the climax, must do a great deal to increase population on the American shore of the North Pacific, and to render a telegraph line profitable. For ourselves, we may say that we expect to see one or even two Pacific cables laid very soon, but we see scarcely less reason for expecting "F. R. G. S's." alternative route to be developed also.

THE CONDENSER AS A TRANSFORMER AND REGULATOR.

Elsewhere in this issue is printed an account of two recent patents granted to Prof. M. I. Pupin, which illustrate several of the valuable properties possessed by condensers when associated with inductances. There is scarcely any employment of alternating current where the condenser would not be a valuable adjunct, but thus far, except in certain branches of telephony and telegraphy, its use has not been found commercial owing to either cost or unreliability. It was in connection with the alternating current motor that its use in large capacities was perhaps first indicated, and much ability was exercised without success to produce a type that would eliminate the objections above referred to. At present it appears that the inherent difficulties in the way of commercial condensers of large size and of reliability are insuperable, though, of course, for classes of work such as encountered in telegraphy and telephony this does not apply.

The valuable property of a condenser lies in the fact that a reactance set up in it is opposite to the reactance set up in an inductance by a current of the same phase. Thus, if a condenser and inductance are placed in series across a circuit, the reactance of one may be partly or wholly neutralized by that of the other, in the latter case the circuit acting as if it were non-inductive. For example and as an illustration, assume an alternating current line of 100 volts, and suppose that across it is placed a 50-volt lamp in series with an inductance of .293 henry. Owing to the reactive e. m. f. set up, but 20 volts will appear at the lamp, while there will be 98 volts between the terminals of the inductance—the two e. m. fs. not being in phase. If a 50-volt lamp be placed in series with a condenser of 4.88 microfarads across the same circuit, there will be a similar distribution of voltage—20 volts at the lamp and 98 at the condenser. If, now, both lamps are placed in series with both the inductance and condenser across the same circuit of 100 volts, the two reactances will be nullified and both lamps will glow at the full voltage of 50 and, moreover, a voltmeter will register 245 volts at the terminals of both condenser and inductance. The cause of the larger e. m. f. at the two lamps is, as stated, the neutralization of the reactive e. m. fs., while the increased current thereby set up in the circuit raises the value of the reactive e. m. f. above that of the impressed e. m. f. From the above the reason is apparent why either a condenser or inductance, if associated together, may act as a transformer. As the power factor of induction motors is due to the inductance of such motors, it is also apparent from the above why the condenser would be a valuable adjunct to the operation of this class of motors, or wherever it is desirable to nullify inductance. It is a somewhat singular fact that under certain circumstances a synchronous motor or rotary converter will act as the equivalent of a condenser. As the speed of such machines being constant, by changing the field, the armature counter e. m. f. can be adjusted at will. The phase of the current flowing with respect to the impressed e. m. f., is determined by the resultant of the counter e. m. f., and the armature reactive e. m. f. and ohmic drop. By a strong field excitation this resultant may give rise to a leading current precisely as if the machine were replaced by a condenser.

PARALLEL OPERATION OF DIRECT-COUPLED ALTERNATORS.

The article of Mr. Emmet on this subject appearing in this issue is of interest and practical importance. The position assumed is very reasonable. When two alternators are operated in parallel, we know that a slight relative displacement of phase may occur between them. This may be brought about by any one of a variety of causes. Once the relative displacement has been effected, cross-currents flow between the two machines, tending to bring them into unison. The inertia of the revolving parts causes them to overshoot the point of unison and to become phase displaced in the reversed direction. The result is a series of cross-current oscillations, and a series of phase oscillations, in a period depending upon the electrical and mechanical inertia of the armatures. If no resistance to displacement existed either of a mechanical or electrical nature, such oscillations should persist undiminished for an indefinite period, unless altered by the same accidental causes as originated them. The electrical resistance of the armatures inevitably tend, however, to the absorption of oscillation energy, and consequently all such deviations from strict unison or synchronism should speedily die out unless maintained by some extraneous source. This source may readily be, and no doubt usually is, the pulsation or hunting of the governors in the

prime movers. If the period of free oscillation in the latter approximates to the period of oscillation of the two armatures, the deviations will tend to augment until the alternators break out of synchronism; while if the governor period is markedly different from the armature period, the oscillations do not increase.

An evidence in favor of the theory advanced is the fact that alternators driven from the same prime-mover, such as a common shaft, are much less likely to pump than alternators driven from separate prime-movers. In some cases the pumping tendency may be so great between two separate direct-coupled units, that parallel running is rendered practically impossible. When we remember that most of the large systems for the electric transmission of power employ a number of synchronously operated alternators, the importance of safeguards upon the synchronism is self-evident. The tendency to suppress oscillations and maintain exact synchronism is always considerably increased by the insertion of electrical resistance in the leads between the alternator armatures and their busbars; i. e., by adding resistance to the circuit including the armatures; but this is of course a wasteful process because it entails loss of energy as heat in the inserted resistance. The theory, however, is equally apparent in this case that the extra resistance tends to more readily absorb the energy of the oscillations. The ideal prime-mover for driving alternators in parallel should have a very sensitive governor, but one which possessed a sluggish action due to frictional forces as distinguished from inertia. Such a governor would respond slowly but steadily to all changes in speed but would not hunt to any appreciable extent.

In the early days of incandescent electric lighting by direct-current dynamos, considerable difficulty was experienced in causing the dynamos to run in parallel. This was owing to the fact that the regulation of speed in the then new high-speed type of steam engine was comparatively imperfect. One dynamo might so far outrun its neighbor as to take all load, or even to drive its neighbor as a motor. This condition would be reached when the percentage increase in speed was equal to the percentage of voltage drop in the armature under total load. Improved speed regulation has long made the clashing of parallel direct-current units impossible, and the time will no doubt come when the pumping of alternators operated in parallel will be equally a matter of history. With them there is no danger of loss of synchronism by reason of variation of voltage. We know, in fact, that two alternators may operate perfectly in isochronism when their excitations and generated e. m. fs. are widely different. The difficulty arises from the effects of the cross-currents in tending to diminish the deviation without arresting it completely at the instant of unison.

SOME POINTS IN PATENT LAW.

We have been asked in what manner the rights of an inventor would be affected were he to describe his patent in print before applying for a patent. Assuming always that the description is so clear that others skilled in the art can practice the invention, he can obtain a valid American patent provided the publication did not occur more than two years prior to his application. He cannot, however, obtain under the same circumstances a valid patent in the principal foreign countries. The various changes of recent date in our laws do not, of course, affect the laws of foreign countries, which have always refused a patent for an invention described in a printed publication before the filing of the application. "Publication" in Great Britain means within the realm, but in other countries it means in any country. The American law referred to has been in force only since July, 1899; previous to that, prior publication had no effect on the American patent, unless such publication was in the form of foreign Letters Patent, in which case the American patent was limited in term to that of the foreign patent having the shortest term. Under the law of July, 1899, a prior foreign patent does not now affect the American patent unless the application on which the foreign patent was granted was filed more than seven months prior to the filing of the application in this country, in which case no patent will be granted in this country.

Another query to which we have been invited to give an answer is as follows: "Suppose a fundamental patent were granted on an invention in 1883, which secured a monopoly to the great profit of its owner. In 1900, a few months before the expiration of the patent, the Patent Office gives judgment in an interference suit to another inventor and issues a patent to him. What would be the status of the first patentee, the second patentee and the public?" It is difficult to see how such a condition could exist, for the interference in the Patent Office which must have been declared in the infancy of the first patent, was practically before the public for seventeen years, and the public would not have paid tribute while the validity of the patent was in doubt, and the owner of the first patent would not have enjoyed a monopoly. He certainly could not have obtained an injunction from the courts while his patent was in interference in the Patent Office. Under the old rules it was possible to nurse an interference along till the first patent nearly expired. Then, if the second patent issued, there is no doubt that it would convey a monopoly for a second seventeen years. The grantee of the second patent would have no claim for damages against the holder of the first patent, because the first patentee received his patent in good faith, and it was issued by the Patent Office in good faith. The interference was merely an incident, the result of which both parties had to accept. If any one should recover it would be the public, which paid royalties to the first patentee but nevertheless could not recover because it acknowledged the validity of the patent by the act of paying the royalties. It does not appear probable that an interference of the kind assumed could in fact result in two monopolies of seventeen years each. The second seventeen years would cover the only real monopoly, while the first would be a period in which the invention would be held up "in litigation," no one daring to touch it.

A third point having reference to patent law has been brought forward by a recent decision which is considered in an article elsewhere in this issue by Mr. Arthur F. Kinnan. It appears that an inventor filed an application for a patent accompanied by claims limiting the invention in its scope. Two years later, another inventor filed an application for a patent disclosing a machine which, while it is specifically different from that of the inventor, accomplishes the same result in an equivalent manner, but his application was accompanied by a claim for invention so broad in its scope as also to cover the device of the first invention. Later, the first inventor filed a claim similar to this latter one, and a contest was instituted to determine which party should be allowed to have the broad claim. At every step of the contest in the Patent Office the first inventor was declared to be entitled to the broad claim, but when the case was carried to the Court of Appeals, the extraordinary decision was made that while the first patentee was the prior inventor, neither party was entitled to the broad claim at issue—that the second party could not have it for the first party invented the subject matter first; and the latter could not have it because he did not present the claim until after the second party had presented it. This decision, which is stated to be neither supported by patent law nor countenanced by equity, is accompanied by the peculiar situation that there is no appeal from it. That is, while one of the contestants is declared to be the first inventor, he has no legal channel through which to contest the court's decision against his claim to enjoy the rights of prior invention.

Mr. Westinghouse on Refuse Utilization.

The subjoined interesting letter was addressed last week by Mr. George Westinghouse, Jr., to the New York *Times:*

The bringing together of the gas and electric light and power interests in New York should result in great advantages to the public and to the interests so combined, provided the latest developments in gas and electric engineering are investigated and availed of. Among the numerous questions affecting the health, comfort and convenience of the citizens of New York (and of all communities, in fact,) are three of especial importance viz.:

The disposal of garbage, the abatement of the smoke nuisance due to the increasing use of bituminous coal for steam power purposes, and the securing of an adequate supply of water.

From statistics there appear to be created daily in New York about 500 tons of garbage, or at the rate of one-half pound per capita. Such garbage is about 20 per cent. carbon and 80 per cent. water. By a process which has been well demonstrated on a small scale, and which is being rapidly brought to a commercial basis, all of this garbage can be economically, and without offensive odor, converted into a fuel gas of great value. In the same apparatus and by the same process soft coal can be made into a gas suitable for power and heating purposes.

The fuel gas made from garbage and soft coal can be used to drive gas engines with electric generators, and the electricity thus produced can be used for light and to drive motors to the exclusion of the thousands of steam engines and boilers which make such demands upon the water supply, since the gas engine central stations can be so located that the water needed for engine-cooling purposes can be taken from the river.

Bearing upon these questions, and of especial importance, are the partially executed plans of the electric power and light corporations, viz., the Metropolitan, Third Avenue and Manhattan Elevated Railways, and the New York Gas & Electric Light, Heat & Power Company and the United Electric Light & Power Company. If their present plans, which are fairly well known to the engineering profession, are carried to completion, each will have one large steam station on the East River between Twenty-ninth Street and the Harlem River, with about 75,000-hp of engines, boilers and electric machinery, making an aggregate of 375,000-hp, and which may be largely increased when the underground rapid transit railway is completed, and still further when the electric locomotive is used on all steam railways within the city limits.

If these corporations, which might as well buy electricity as the machinery, coal and water with which to produce it, were to unite in a common plan to provide the electricity needed in their operations by the adoption of the best available methods, the saving to each in capital expenditure would be very great, and the decreased cost of their supply of electricity would make an important addition to their earnings applicable to the payment of dividends; while, most important of all, the citizens of New York would have solved for them the garbage, smoke, and very largely the water questions.

I believe the contemplated plans of the corporations above named, which can be shown to be based upon an imperfect knowledge of the subject, will stand in the way of vast public interests, and, so believing, I have said to representatives of some of those companies that the near future would demonstrate the projected power stations and systems of electrical distribution incidental to the character of such stations, to be as far from the best as are the old cable systems for the propulsion of cars.

I write this letter because I believe these subjects are just now worthy of investigation, discussion and elaboration.

Commenting on the above, Dr. Cary T. Hutchinson writes: Mr. Westinghouse estimates the amount of garbage available daily in New York City at about 500 tons. He implies that this amount of garbage converted into gas and used in gas engines would be sufficient to supply a material part of the output of the great power plants that he refers to. Experiments made in England based on the burning in steam boilers of 26,000 tons of ordinary city refuse show that one pound of such refuse will make one pound of steam. On this basis, assuming the best engines and electric generators, twenty-five pounds of refuse would be required for each unit (kw-hour) output of electric energy from the power plant.

Mr. Westinghouse, however, does not propose to use the refuse for making steam, but purposes converting it into a fuel gas. He gives no data as to the value of the refuse used in this way, beyond the statement that "all the garbage can be converted into a fuel gas of great value." It is simple, however, to give an approximate idea of the possible limit to the efficiency of a process of this kind.

Assuming the analysis of the garbage given—that is, 20 per cent. carbon to 80 per cent. water—the maximum theoretical heating value of one pound of refuse is very approximately 2000 thermal units; if all this energy can be recovered in the form of a gas—that is to say, if the efficiency of the energy conversion from refuse to gas is perfect, and assuming a ratio of 20 per cent. between the energy in the form of electricity and the theoretical energy of the gas a high figure—it would require 8.5 pounds of refuse per unit (kw-hour) of electric energy. This figure fixes the maximum theoretical duty of a pound of such refuse when converted into a gas and used in a gas engine. It is not probable that the actual commercial duty of the process will equal 15 pounds of refuse per kw-hour.

That is, a consideration of the elementary principles involved shows a probable d ty of 15 pounds of refuse per unit (kw-hour) in comparison with 25 pounds, deduced from extensive tests on steam. This difference represents the possible improvement due to the use of gas engines.

Assuming then that a unit of electric energy can be obtained from 15 pounds of refuse, the 500 tons would yield about 67,000 units. As Mr. Westinghouse truly says, the aggregate power of the large steam plants mentioned is approximately 375,000-hp. The daily output of these plants will be approximately 2,500,000 units; in other words, the maximum result that could be got from the consumption of all the garbage of New York City in the way that Mr. Westinghouse describes, would supply about 2½ per cent. of the daily output of power from these stations alone. This is so trifling that it is hardly worth consideration, not being even sufficient to drive the pumps and auxiliary apparatus in the various power houses.

Looked at from another point of view, the daily demand for power from these stations will call for the consumption of nearly 3500 tons of the best coal. Mr. Westinghouse proposes to use 500 tons of refuse to do the work of 3500 tons of good coal.

The Automobile and Bicycle Show in New York.

Beginning January 20, and continuing for a week, an automobile show will be held at the Madison Square Garden, New York, of which Mr. Frank W. Sanger is the manager. It will be in conjunction with the annual cycle show, and the management is more than pleased with the manner in which the motor vehicle manufacturers have interested themselves in the exhibition. More space than ever before has been rented, and the automobile manufacturers will be an important part of the exhibition. Every style of self-propelled vehicle will be included, from the little runabout to the heavy trucks which are now being used for transportation. The various styles of motors will also be seen. For the benefit of exhibitors it might be stated that when sending goods to the show they must be marked with the name of the consignor and the number of the space, addressed to the Madison Square Garden, New York City, and will be received only at the Fourth avenue and Twenty-seventh Street entrance, where a receiving clerk will take charge of them and send a printed notice of the arrival of goods to the space for which they are marked. Charges of all kind must be prepaid. The show will be open from 10 a. m. until 10:30 p. m. each day, from Saturday, January 20, at 8 p. m., to the following Saturday, exclusive of Sunday. Storage for goods can be secured in the exhibition hall. Of course there will be all the other privileges which Manager Sanger, of the National Cycle Exhibition Company, has always afforded exhibitors at cycle shows.

Any regularly qualified bicycle or automobile agent, manufacturer, exhibitor or employee of exhibitor, will be admitted to the Garden free from 9 a. m. to 1 p. m. daily, by giving his name and address at the bureau of information.

As usual there will be a fine display of electric lighting at the Garden, in connection with the show. In addition to the regular and official lighting, there will be a large amount of decorative, and some 20,000 big and little lamps will be employed. A great many of the signs for bicycles and automobiles will be worked out in colored incandescent lamps over the respective exhibits. Considerable work on these lines has been done during the current week, and the result is that some very fine effects are promised.

Preparations for this show have been in progress for some time past and duly noted in these columns. There is every reason to believe that is will be one of the most attractive exhibitions ever held in the Garden.

Electrical Preparations for the Paris Exposition.

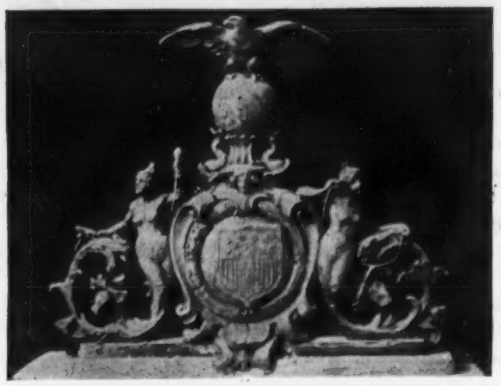


FIG. 1.—DETAIL OF ORNAMENTATION.

ONE of the most interesting features at the Paris Exposition to electrical and mechanical engineers, outside of those to which attention has already been directed in these pages, will be the United States Court of Honor for a complete retrospective exhibit of electrical and mechanical apparatus of a pioneer or historical character. This court will constitute part of the main building or space devoted to electricity and machinery on the Champ de Mars, and a large sum of money is being expended to render it worthy of its high function. We are enabled through the courtesy of Mr. James S. Anthony, Assistant Commissioner of the Department of Electricity, Machinery, etc., to present illustrations made from the models prepared for the court in this country, after the designs of Mr. Clarence Luce, of New York. These designs were successful in a severe architectural competition, and have been worked out in staff by Biel & Mauch, of Chicago, who are responsible also for the modeling of the Dewey Arch on Fifth Avenue. The cuts give a fair idea of the court and its decoration. It will be wholly of plaster and staff, finished in green bronze and ecru, or deep cream, ornamentation. The space occupied, all told, will be about 5000 square feet, and the plan shown will give a good idea of the arrangement and grouping of the exhibits. It is hardly necessary to recapitulate here what will be exhibited as the items are carefully set forth in Fig. 2. Mr. Anthony has devoted months of careful study to the collection and authentication of these objects and models, and has ransacked the country for them, as well as delved deep into public and private archives and galleries. Morse, Henry, Bell, Brush, Farmer, Sprague, Short, Thomson, Edison, Van Depoele, Davenport, Oliver Evans, will all be there as represented by what the work of their brains and hands did to promote American invention and industry during the nineteenth century.

As to the special supplementary machinery building at Vincennes, illustrated recently in these pages, intended for larger operative exhibits, a despatch from Paris states that Mr. Francis E. Drake, Director of Electricity and Machinery in the American section, has arrived there to hasten the construction of the building. The structural iron has arrived on the Prairie, with a gang of American workmen, whose rapid work and improved appurtenances create interest among the foreign workmen. Mr. Drake expects to have the building under its roof in a month and ready to accept exhibits. He says progress on all the buildings of the exposition is further advanced than at the Chicago Fair at the same time, and he believes the exposition will be opened at the promised time.

Assistant United States Commissioner Woodward reports as one of the most important victories of the United States Exposition Commission over the French officials the exoneration of all printed advertising matter, circulars, prospectuses and pamphlets from customs duties. The rate—$22 per 100 pounds—was prohibitive and would have seriously detracted from the benefits expected by the American exhibitors.

The Vincennes Annex has not yet been constituted into a bonded warehouse, though the commission three weeks ago announced that it was in order to encourage early shipments. In consequence Mr. Woodward had a hard struggle with the French Custom House, and was finally compelled to store the official exhibits brought on the American cruiser Prairie right and left in Paris under government seals till released.

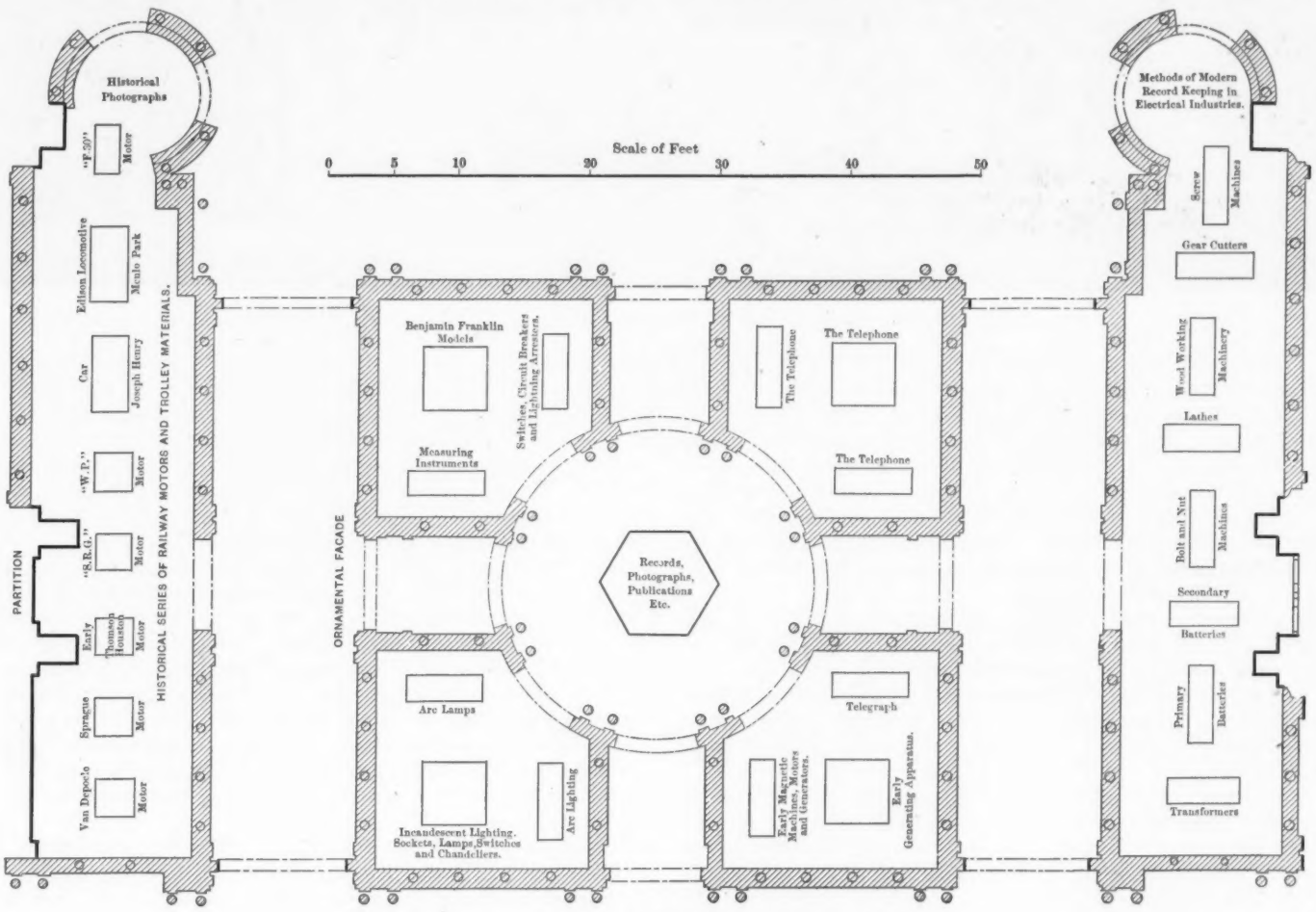


FIG. 2.—PLAN OF HISTORICAL EXHIBIT IN COURT OF HONOR.

We append a list, fairly complete, and including all the names so far given out, of electrical and mechanical exhibitors: American Electric Vehicle Company, Chicago, Ill.; American Hard Rubber Company, Akron, O.; American Steel & Wire Company, New York; American Wireless Telegraph Company, Milwaukee, Wis.; Ball Engine Company, Erie, Pa.; Belden-Larwill Electric & Mfg. Company, Fort Wayne, Ind.; Bullock Electric Mfg. Company, Cincinnati, O.;

M. C. Bullock Mfg. Company, Chicago; C & C Electric Company, New York City; Christensen Engineering Company, Milwaukee, Wis.; Cling-Surface Mfg. Company, Buffalo, N. Y.; Columbia Automobile Company, Hartford, Conn.; Crocker-Wheeler Company, New York; Cutter Company, Philadelphia, Pa.; Thomas A. Edison, Orange, N. J.; Ferracute Machine Company, Bridgton, N. J.; Garton-Daniels Company, Keokuk, Iowa; General Electric Company, Schenectady, N. Y.; General Equipment Company, Camden, N. J.; Gold Street Car Heating Company, New York; Indiana Bicycle Company, Indianapolis, Ind. (automobiles); Jeffrey Mfg. Company, Columbus, O.; Jewell Electrical Instrument Company, Chicago; Lakon Company, Elkhart, Ind.; Ward Leonard Electric Company, Bronxville, N. Y.; Link-Belt Machinery Company, Chicago; McGraw Publishing Company, New York; McGuire Mfg. Company, Chicago; Meitz & Weiss, New York; Milwaukee Electric Company, Milwaukee, Wis.; Montauk Multiphase Cable Company, New York; New York & Ohio Company, Warren, O.; Ohio Electric Specialty Company, Troy, O.; Otis Elevator Company, New York; Philadelphia Electrical & Mfg. Company, Philadelphia, Pa.; Q & C Company, Chicago; Riker Electric Vehicle Company, Elizabethport, N. J.; Roebling's Sons Company, John A., Trenton, N. J.; Rowland Multiple Printing Telegraph Company, Baltimore, Md.; Schieren & Co., C. A., New York; Shaw Electric Crane Company, Muskegon, Mich.; Smith & Co., S. Morgan, York, Pa.; Speer Carbon Company, St. Mary, Pa.; Standard Telephone & Electric Company, Madison, Wis.; Stilwell-Bierce & Smith-Vaile Company, Dayton, O.; Stromberg-Carlson Telephone Mfg. Company, Chicago; Tesla, Nikola, New York; Varley Duplex Magnet Company, Jersey City, N. J.; Wagner Electric Mfg. Company, St. Louis, Mo.; Warren Webster & Co., Camden, N. J.; Weber Railway Joint Company, New York; Western Electric Company, Chicago; Western Telephone Construction Company, Chicago; Westinghouse Electric & Mfg. Company, Pittsburg, Pa.; Weston Electrical Instrument Company, Newark, N. J.; Wheeler Condenser & Engineering Company, New York; Williams & Co., J. H., Brooklyn, N. Y.

Commissioner General Peck has just received copies of the new French law for the protection of inventions and trade-marks and registered trade-mark articles exhibited at the coming exposition. This law remedies many of the difficulties which at first presented themselves to proposing exhibitors. The regular French law governing patents is peculiar in that it allows no exhibition of an invention on French territory prior to the application for a patent.

The new law allows exhibition at the exposition and gives the inventor until three months after the close of the exposition to apply for his French patent. Under the old law the importation into France of a patented article, without permission of the French government, would vitiate the patent. By the new law all exhibits at the exposition are allowed to come in without danger to existing patents. The regular French patent law also requires that patented articles must be made in France within a certain time after the patent has been granted. The new law provides that all holders of French patents who may exhibit such articles as are covered by their patents will be entitled to count the period of the exposition and three months additional time as equivalent to manufacture in France. This will, in many cases, effect a saving equal to the cost of exhibition, especially in cases of complicated construction or large articles of manufacture.

Trade-marks are also provided for in the new law. The laws of France against counterfeiting trade-marks are very severe, having a penal clause accompanied by seizure of goods bearing the infringing trade-mark. The new law outlines the method of procedure against counterfeiters, and United States exhibitors will in all probability incur less danger of having their trade-marks infringed in France than in this country, because of the severity of the French law. The official list of trade-marks and copies of the French patent and trade-mark laws and treatises thereon are placed at the disposal of exhibitors, without charge, by the United States Trade-Mark Association, Mutual Life Building, New York, in order that exhibitors or their representatives may know in advance what trade-marks are officially registered by the French government.

The exposition will open Saturday, April 14, and close Monday, Nov. 5.

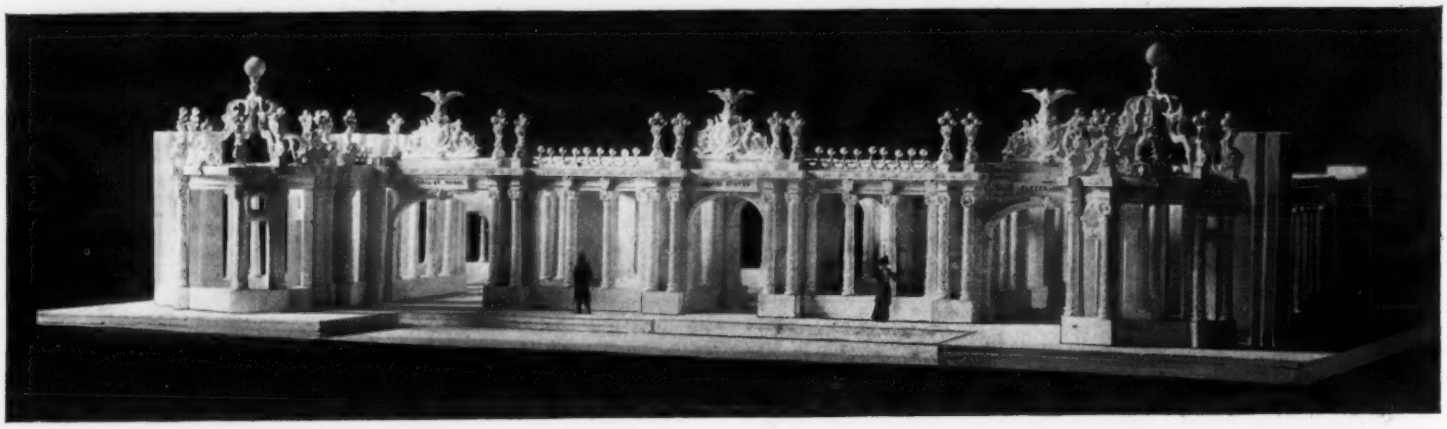


FIG. 3.—ELECTRICAL AND MECHANICAL COURT OF HONOR, U. S. A. PARIS EXPOSITION.

The Factors Which Determine the Design of Mono-Phase and Polyphase Generators.—I.

BY B. A. BEHREND.

THE path of the designer of alternating current machinery has been beset with extraordinary difficulties. At a time when direct current machines could be designed with an accuracy equaling that with which the dimensions of steam engines can be predetermined, the designer of the alternator was still groping in the dark. The invention of the asynchronous single and polyphase motor, though stimulating and enhancing the interest attached to the solution of the problem, only increased, at first, the difficulties. It was found that alternators which gave satisfactory results when working on non-inductive loads, were utterly worthless for induction motors. To the surprise of many a designer, the drop of voltage was so immense that by no increase of the exciting current could the voltage at the terminals be raised to its proper value.

An explanation of this phenomenon was afterward easily given, and our periodicals were rife with mathematical theories to account for the observed phenomena. I am far from thinking that such speculations are without value—they very often hasten the approach of the final solution of a controverted question, but as they usually abound with *a priori* assumptions which are by no means justified by experiment, they are like a double-edged sword in the hands of the designer. Long deductive arguments, not based on the solid ground of experiment, are premature, and the energy wasted on them would far more wisely be spent in widening our knowledge of experimental facts.

There was another factor which contributed to obscure the real points at issue, viz., the frequency of the alternating current. The frequency of alternating currents has not sufficiently been dealt with from the standpoint of the designer of the alternator or motor, but only from the standpoint of the light-installing engineer. He held that the frequency, or number of complete periods per second, ought to be, for his transformers and lights, at least over fifty, and frequencies of about eighty did not belong to the exceptions, but were rather the rule. Now, such high frequencies may be justified as long as the alternating current is dissipated altogether in heat or light, in which case the greater inductive drop, accompanying the higher frequency, being in quadrature with the current, is not fatal. As soon, however, as inductive currents were taken from these machines with high frequency, the

voltage at the terminals dropped beyond control, betraying the unsatisfactory design of the generators.

In America the designers resorted to an expedient, curing, so to say, the symptom, but not doing away with the real evil; viz., they compounded their generators; while in Switzerland and also in Germany, the only countries in Europe that took part in the development of polyphase work, other ways were chosen. We can hardly think of a country more favorable to the development and spread of so flexible a system as the polyphase current system, than Switzerland. A rich country, abundant in water power, covered with villages and fine hotels, full of small industries, needing light and power over comparatively large areas, Switzerland has proved a hotbed for the growth of the polyphase currents. And it was in the Oerlikon Engineering Works in Switzerland that the author had the opportunity of investigating the principal factors which determine the design of alternating current machinery. The following article contains some of the results at which I have arrived.

I propose to deal with the problem in the following manner: We shall first mention the factors which are necessary to predetermine the static characteristic of the alternator. We shall then turn to the methods by which the dynamic characteristic can be determined, and shall discuss them in the light of a series of experiments. The last chapter will be devoted to the influence of the frequency, of the pole-pitch, and of the air-gap, on the drop. The results there attained will furnish us a simple and very useful method of designing alternating current machines.

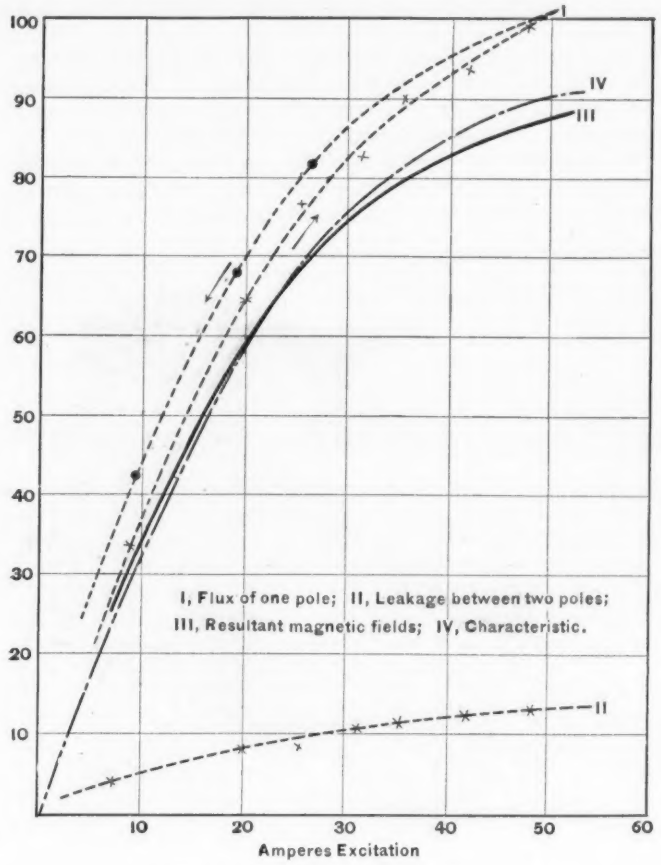


FIG. 1.—LEAKAGE TEST CURVES.

THE STATIC CHARACTERISTIC OF THE ALTERNATOR.

This section may be briefly treated, as Mr. Gisbert Kapp's excellent works on the subject give all information desirable. Some points here touched upon are inserted only for the sake of completeness.

The following formula gives the value of the effective e. m. f., e, which is induced in the armature possessing z active conductors:

$$100\, e = k \sim z\, F\, 10^{-6} \text{ volts} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In this formula $\sim$ stands for the frequency, that is, the number of complete periods in one second; z, as said above, is the number of conductors or wires that are cut by the lines of induction; F is the number of lines of induction emanating from each pole, in C. G. S. units; k is Mr. Kapp's coefficient, dependent upon the ratios of the width of the coil and the width of the pole to the pitch of the poles. The following table contains the value of k for different arrangements, after Kapp:

Width of coil / Pitch of pole		0	1/3	1/2	2/3	1
Width of pole / Pitch of pole	1/1	2	1.76	1.64	1.49	1.16
	2/3	2.46	2.31	2.13	1.94	1.49
	1/2	2.83	2.50	2.32	2.12	1.64
	1/3	3.46				

If the leakage at the edges of the poles—the fringe of the magnetic field—is properly taken into account, the values of k in the table give very good results for machines with revolving poles of alternately varying sign, as well as for inductor generators. There is very little difference in the determination of the static characteristic of machines with revolving poles in which each pole is excited by a single coil, and of ordinary direct-current machines; hence the great mass of experience that direct-current engineers have accumulated, can at once be utilized by the designer of this type of alternating-current machines. The so-called Lauffen type has practically disappeared from the market because of its immense leakage and other drawbacks connected with the revolving circular coil. I need therefore not here dwell upon the bitter experiences with this machine. I should like, however, to make some remarks about the inductor generator, which still enjoys a better reputation than it deserves.

From the standpoint of the electrician these machines are inferior to those with alternating poles on account of the leakage between two adjoining pole-horns, which conditions I shall immediately illustrate by some curves. From the standpoint of the mechanical engineer the high induction in the air-gap—which must be kept small on account of the leakage—causes, even with very slight eccentricity of the revolving part, such immense one-sided magnetic stress that the shaft has to be made far heavier than in the revolving pole type, and difficulties with the bearings, if not very amply proportioned, are by no means exceptional.

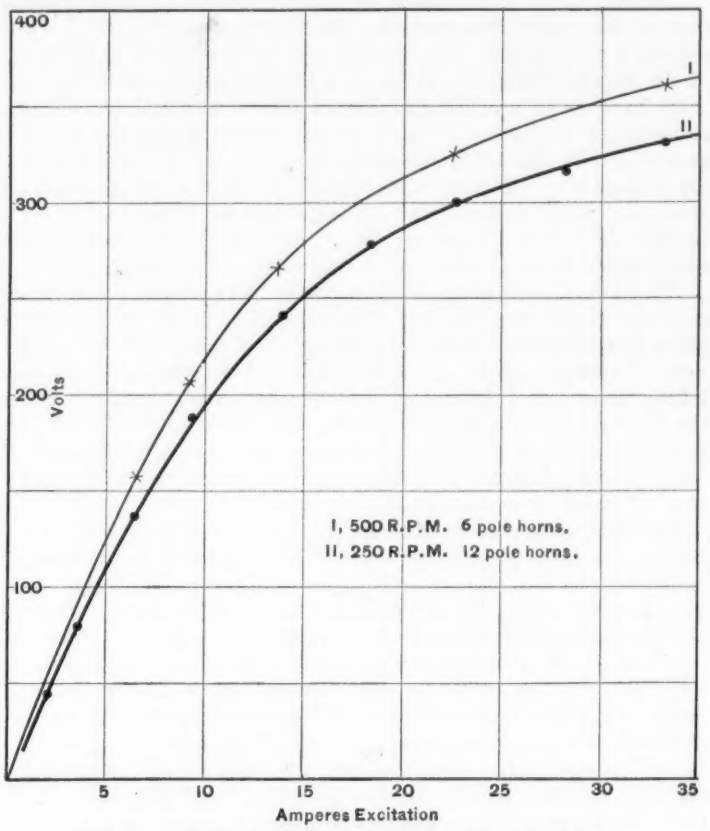


FIG. 2.—CURVES SHOWING INFLUENCE OF POLE PITCH.

I measured in 1897 the leakage in an 800-k. v. a. (kilo-volt-amperes) generator designed by Mr. Emil Kolben a year before in the Oerlikon Engineering Works. The method employed was one that Mr. Kapp had used a long time before for determining the leakage in direct-current machines. The method is based on the same principle as the instrument of the late Dr. John Hopkinson for determining the magnetic properties of iron. A coil was formed of some turns of a very thin wire which was affixed to a sheet of cardboard. The coil had the same dimensions as the armature coils, the pitch of the coil being equal to the pole-pitch. The ends of this exploring coil were

connected to a ballistic galvanometer; in our case a sensitive Weston instrument was sufficient.

The air-gap of the generator was 0.5 cm., the pole-pitch 23.5 cm., the width of the pole 23.5 cm., equal to the pole-pitch. While the inductor of the generator was standing still, the field was excited, the exploring coil was placed between a pole-horn and the armature, and then pulled out. The deflection of the galvanometer is thus proportional to the total number of lines of induction entering the armature from one pole-horn of the inductor. The coil was then placed between two adjoining pole-horns, and again pulled out. The deflection measures the leakage field, which acts in an opposite direction to the main field.

The curves in Fig. 1 show the result of these tests. The abscissæ of the curves represent the exciting current, the ordinates the deflection of the galvanometer. The two curves, measured as described above, are represented in broken lines, while the resultant magnetic field is represented by the full line curve. The curve, plotted thus, —.—.—.—.—, is the static characteristic of the generator. The almost perfect agreement between this curve and the curve of the resultant magnetism is interesting to notice. If the resultant magnetism is set equal to 100, then the leakage field has the following values for different excitations:

Exciting current.....	10	20	30	40	50	amperes.
Leakage field.....	14.3	13.8	13.4	14.6	15.3	amperes.
Resultant field.....	100	100	100	100	100	amperes.

The leakage between adjoining poles is therefore about 15 per cent. of the resultant magnetism. In other words, the leakage field induces a counter e. m. f. in the armature coils equal to 15 per cent. of the resultant magnetism; besides, the cross-sections of the iron parts have to be proportioned for all these leakage lines. *Hence, this leakage of 15 per cent. is equal to a leakage of 30 per cent. in a generator with alternately wound magnets.* It may be remarked that the leakage thus measured does not include all the leakage lines, as some are entering the frame holding the two armatures without passing through the armature coils. But this leakage field is not considerable and may generally be neglected.

The leakage coefficient varies, of course, between certain limits in machines of the same type but of different size. The factor is partly dependent upon the ratio of the air-gap to the width of the poles; partly dependent upon the *absolute* value of the pitch of the poles. I have never found the leakage factor under 20 per cent., this being the lowest value found in machines with an air-gap of 1-16-inch and a pole-pitch of 9 inches, while in generators with a pole-pitch of 5 inches and an air-gap of ⅛-inch for slow speed, the leakage factor rose to the immense value of 45 per cent.

That the absolute value of the pole-pitch is of such paramount importance is quite clear if we bear in mind the fact that the magnetic resistance of the air-gap in direct current dynamos with slotted armatures is hardly increased by the open slots. We cannot emphasize this point strongly enough, as a small pole-pitch has been the cause of the failure of many a generator, and as these machines chanced to be for high frequencies in the majority of cases, the failure was attributed to the high frequency, though in fact due to a too small pole-pitch. We shall return to this point in the section of this article discussing the short-circuit characteristic.

Fig. 2 will demonstrate the influence of a small pole-pitch on the static characteristic of the generator. Curve I. represents the characteristic of an inductor-generator, running at a speed of 500 r. p. m. and developing a three-phase current of 50 p. p. s. The number of pole-horns is six on each side of the exciting coil. The pole-pitch is equal to the width of the poles, viz., 27.6 cm. Curve II. represents the characteristic of a generator of the same type and size, running, however, at a speed of 250 r. p. m., and being wound for 50 p. p. s. The inductor has therefore twelve pole-horns on each side of the exciting coil, and the pole-pitch is 13.8 cm. The two characteristics ought to be alike, if the leakage in both machines were the same. The tremendous difference between the two curves is due entirely to the great leakage caused by the poles being too close together.

What has been said of the influence of the pole-pitch on the leakage in inductor-generators, holds good, with some qualifications, also of generators with alternating poles, though the increase of the stray field is not so immense as in the case of inductor-generators, because the leakage lines do not induce a counter e. m. f. in the armature. While the leakage factor in the generator, the characteristic of which is represented by Curve II., proved to be about 45 per cent., the leakage coefficient for a generator with alternating poles and a pole-pitch of 14.1 cm. was 30 per cent. for the same ampere-turns in the field. The air-gap of this generator was 0.35 cm., while the air-gap in the inductor-generator was only 0.3 cm. These figures show clearly the superiority of the alternating-pole generator over the inductor-generator.

Thus all our experiments in regard to the static characteristic impress upon us the paramount importance of a great pole-pitch, if we desire to keep the leakage within reasonable bounds.

American Types of Automobiles.—V.

THE DESIGN, CONSTRUCTION AND CONTROL OF ELECTRIC MOTORS.

By F. B. RAE.

THE design, construction and control of electric motors for road traction embraces several problems which do not seem to have been always carefully considered in the development of the electric automobile industry, so rapidly assuming a practical commercial condition. Two very distinct types of electric automobiles are presented by the more prominent companies of the West—one in which "lightness" is the dominant idea and to which all else seems to be sacrificed; and the other exhibiting massiveness which apparently is connected with the duty of carrying a battery that will stand the enormous discharge rate to which the design of the motor system subjects it.

Considering the motor application to the driving wheels of both types and the method of control adopted—which are not dissimilar—the total efficiency at the rim of the wheel leaves much to be desired in each type; while in both there are found conditions preventing the realization of the successful economical operation which is found to-day in electric railway practice.

If we consider the electric road vehicle simply as a problem in traction—and the conditions involved do not differ materially from those of the street railway—we have in each case a total rolling load that must be started from rest, accelerated and maintained at speed under constantly varying conditions; and the design and construction and control should meet these conditions. Depending upon the street traffic encountered by the automobile, the stopping, starting, accelerating, slowing down and again getting headway, is greater or less for a run of a given distance, but in any case it must be taken as equal to, if not greater, in point of frequency, than that of a street car making an equal number of miles. The economy with which the vehicle may be started and accelerated becomes therefore one of the main considerations in the design of the motor and its controller, as it has been found to be one of the chief considerations in the economical operation of street cars. In the early days of electric street railways this feature was, for a long time, lost sight of, and more particularly was this true in the effort then made to produce a light equipment. The prevailing idea was to apply the electric motor to the existing horse car, and calculations for design were based upon maximum speed conditions almost entirely. If a car with its equipment had a given weight, and a certain maximum speed per minute were required, then the

FIG. 1.—EXPERIMENTAL ELECTRIC CAB.

formula $HP = \frac{\text{Weight} \times \text{Traction coefficient}}{33{,}000} \times \text{Speed}$ solved the problem for a level road, and two motors of 5-hp each at maximum speed were at first considered sufficient to meet the conditions o the average road for a 16-foot car.

It took but a short time, however, to determine that motors of this size were entirely inadequate to start and accelerate the car from rest to maximum speed within the time necessary, and the increase in size and horse-power to meet these conditions proceeded from two motors of 5-hp to 7½-hp and then to 10-hp. Another brief space and they were advanced to 15-hp, then to 20-hp, while today the average equipment for 16-foot car on level tracks consists of two 25-hp motors. So far as the speed requirements on a level road are concerned, it can be at once determined that 50-hp is not needed for any condition that obtains in ordinary railway practice. To illustrate, assume a load of 10 tons, a speed of 15 miles per hour, or 1320 feet per minute and a resistance to traction of 30 pounds per ton (which is a fair allowance); we then have $\frac{10 \times 30 \times 1320}{33{,}000} = 12$ h.p. as the horse-power required upon a level track. Still a pair of motors developing normally 50-hp and capable of exerting 75-hp for a short time is found necessary in practice, as such practice has been developed by experience.

As in other cases where experience is the teacher, the lesson may be mathematically demonstrated and the reason for the apparently large power required in the equipment of street cars becomes plain where treated as an acceleration problem. To lift the load of 10 tons from rest to speed within the distance found desirable, say 100 feet, assuming the acceleration uniform, calls for 37 mechanical horse-power at the wheel rim; but the acceleration is not uniform, and this together with the lower efficiency of the motor at starting makes the energy in watts, or electrical horse-power, to be applied to the motor considerably more than is represented by 37-hp, and approximately agreeing with the horse-power that practice has demonstrated to be necessary for the weight of the car and load employed.

It would seem, therefore, from the experience had in railway

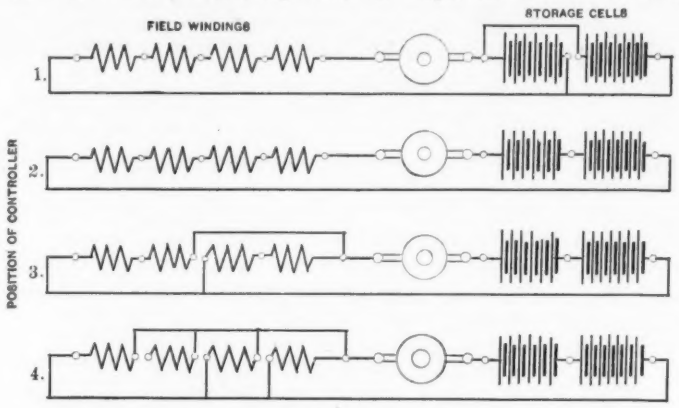


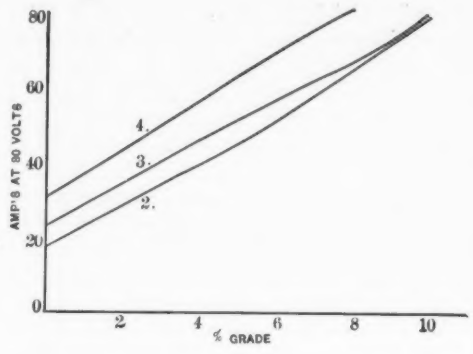
FIG. 2.—DIAGRAM OF GROUPINGS OF FIELD WINDINGS.

traction as regards the rated horse-power of the motors and conquently their size and weight, that the motors applied to automobile work should be correspondingly larger and have the horse-power necessary to start and accelerate the loaded vehicle without undue strain, which means also that the frame, gears and other mechanical parts must be sufficiently heavy to withstand the shock of starting. This argument against lightness in design of motors, running gear, etc., is not to be taken as advocating the other extreme, where massiveness of body, heavy wheels and axles and general ugliness are combined for the purpose of carrying on the springs the load consisting of batteries largely, and not the load on the frame consisting of motors and gearing which in this type are, as a matter of fact, but little larger than the motors, etc., employed in the light types.

In determining the best design of motor for automobile work and its method of control, another and exceedingly important element must be considered, namely—the storage battery as a source of electrical energy. So far as it is necessary to discuss the construction of the storage cells employed in automobile traction for the purpose of this article, it is sufficient to note two general types. The machine designated as the light type generally employ the Faoure or pasted cell, of which there are several makes, differing chiefly in the mechanical construction of the supporting gird and manner of assembling the elements; while the machines of the heavy type invariably use the Plante cell, or a modification of this cell, in which the elements are wholly or partly formed by the action of the current. The average weight of the Faure cells for the ampere capacity usually employed is perhaps 20 per cent. less than cells of the same capacity of the Plante type. Where the cells are subjected to an excessive rate of discharge, as is necessarily the case with the design of motor generally used, the cost of maintenance is undoubtedly less in the Plante type of cell; it is not, however, sufficiently less to warrant the misuse to which the battery is subjected by the excessive rate of discharge necessary to start and accelerate the load with the motors employed.

Whichever type or particular make of storage battery is selected for automobile work, it should be considered primarily as a conservator of energy having well defined capabilities and practical limitations that must be recognized, if successful operation is expected. Makers of storage cells are careful to state the rate of charge and discharge for the best conditions, and to give a maximum rate that should not be exceeded. The limitations have, however, been very generally ignored by the users in the design of their motors and method of control for automobile work, causing a discharge rate in starting three or four times as great as the elements are designed to stand, resulting naturally in the rapid disintegration of the cell plates and condemnation of the battery, which is in no way at fault and has simply been abused.

The problem of electric automobile propulsion, therefore, contains several things besides the mere mechanical application of a



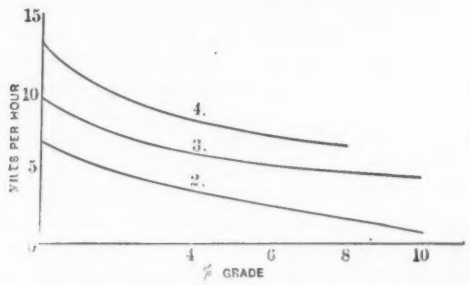


FIG. 3.—CURVES SHOWING PERFORMANCE ON GRADES.

motor to the driving wheels, some storage battery and a switch, assembled to present an appearance different from some other similar application of a motor battery, switch, etc. Such considerations may in part be set down as follows:

(1) The storage battery as the source of electric energy, has a limited capacity and a limited rate at which such capacity may be utilized that must not be exceeded.

(2) An electric motor designed not so much for high efficiency at maximum speed as for high starting efficiency and high efficiency at medium speeds; so that the work of starting and accelerating the vehicle and its load and maintaining the speed desired shall not, under any condition, call upon the battery for current at a greater rate than the allowable and safe excess for the size of plate employed.

(3) A controlling system producing the necessary gradations of speed without expanding energy in resistance or permitting excessive current to flow in starting; and also, in conjunction with the motor enabling the machine to encounter grades at a slow speed while maintaining a torque on the motor equivalent to that developed at maximum duty upon a level.

(4) A system of gearing between the motor and driving wheels that is simple, of high efficiency and of sufficient strength to withstand the most severe usage that the vehicle is liable to encounter.

With the above conditions realized it is apparent that the great economy of operation is obtained and that the mileage rating of such a machine may be safely based upon the watt hour capacity of the cells.

In the expectation of obtaining in practice approximately the conditions of operation considered desirable and as outlined in the preceding statement, there was designed by the writer a motor and system of control embodying his ideas and a vehicle in the form of a hansom cab was constructed to determine the extent to which the conditions sought might be realized and also to afford a practical means for further working out the problem.

TABLE I.

Position of controller.	Speed of motor (r. p. m.).	Speed of carriage, miles per hour.	Current at 80 v.	Time in minutes for one mile.	Watt-hours for one mile.
2	548	6.85	16.75	8.75	196
3	740	9.25	22.50	6.50	195
4	1008	12.6	30.00	4.75	190

The cab in the accompanying illustration was constructed in 1898 by the Rae Motocycle Company, was operated by it experimentally for some months and is still owned by it. It has been in daily service under lease to a livery company for the past six or eight months, and has made a good record for reliability, economy of operation and low cost of maintenance.

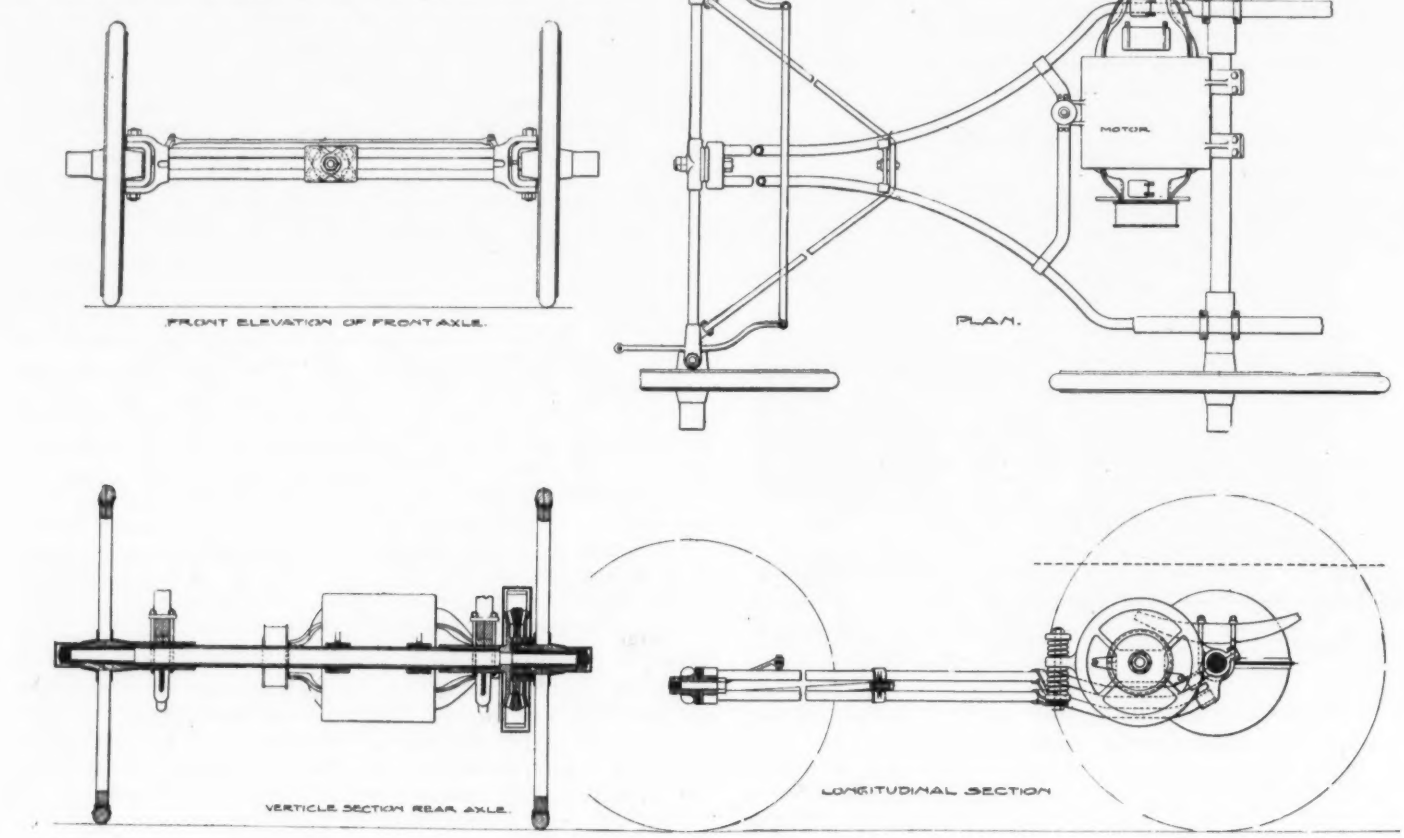


FIG. 4.—DETAILS OF RUNNING GEAR.

Runs of 35 and 40 miles on boulevards with one charge of the cells have been made repeatedly by the writer when operating the cab under efficiency test, but making no particular test for mileage; and from 46 to 53 miles on one charge have been made by the cab in the hands of the livery company.

The cells employed were of the Faure type, forty in number, having a rated output of 125 ampere hours at a 30-ampere discharge, and able to stand a maximum discharge of 45 amperes without undue strain.

A test over a measured mile of macadam and asphalt boulevard (made in each direction to eliminate wind resistance) gave the result presented in Table I.

The watt hours per mile for level road is seen to be practically the same for all speeds, so that the total mileage of the cab may be taken as the watt hours of the battery divided by the watt hours per mile, or in this case $\frac{10,000}{194} = 51.5$ miles. The ability to accomplish the calculated mileage of fifty miles with one charge of the cells upon which the motor and system of speed control was designed, is, therefore, demonstrated; and it is further shown that the fifty miles may be made on a level road at any speed from 6.85 to 12.6 miles per hour at the same cost per mile for electric energy consumed.

The efficiency of the motor and combined efficiency of the motor and gear for the above performance is shown in Table II.

TABLE II.

Position of controller.	Motor speed, r.p.m.	Ampere turns.	$\frac{N}{10^6}$.	C. E. M. F.	Efficiencies.	
					Motor only.	Motor and gear
2	548	7437	2.98	65.25	81.6	73.5
3	740	4995	2.38	73.36	91.8	82.7
4	1008	3330	1.76	75.54	94.5	85.1

In the several positions of the controller as given in the table, the cells are all in series, giving the effect of eighty volts initial pressure throughout the range of speed on a level from 6.85 to 12.6 miles per hour. The change in speed is produced by changing the field magnetization of the motor by a system of series, series-multiple and multiple grouping of the separate field windings, which is accompanied by a controller producing the conditions shown in the diagrams Fig. 2.

In this method of speed control no resistance is introduced to break the initial flow of current upon closing the switch—the watts lost during the interval of time that such resistance might be included in the circuit, being thus saved. Upon closing the switch in the "first" position, the initial flow of current due to $\frac{E}{R}$., neglecting self-induction, is forty amperes, which, of course, at once falls to that required to move the cab. If the motor is permitted to

acquire the speed attainable at this point of the controller before moving to the second point, the peak of the current going from first to second position will not exceed forty amperes, which condition is also true for any other advance of the controller. There is, therefore, expended in the motor $40\times80=3200$ watts in the effort to start the machine from rest, producing under the conditions of the field coil arrangement 17,760 ampere turns as the magnetizing effect, and corresponding to a density of 104,000 lines per square inch in the air gap, which is full saturation of the field iron. This condition agrees with a starting torque of 885 inch-pounds at the periphery of the armature.

As the draw-bar pull necessary to start a load of 3800 pounds on a level is equivalent to a torque of only 210 inch-pounds at the armature, it is seen at once that the motor is capable of starting this load with a current of very considerably less volume, and that ample margin is had for starting on bad roads or upon a considerable gradient against the load within the discharge limitation of the battery.

The performance of the machine on grades is shown in the accompanying curves, in terms of current and speed. From them it will be seen that the design is such as to meet the average conditions of roads and grades encountered within the reasonable excess discharge rate of the battery. To illustrate, if forty amperes is the allowable discharge at which the batteries will not be damaged, then with this current a grade of 4 per cent. may be ascended at 3½ miles per hour, or a 2½ per cent. grade at 6½ miles per hour.

The motor, however, is capable of developing the power required to climb grades of 10 and 12 per cent., and even higher grades have been ascended with the machine.

It will be seen that the equipment consists of a single motor geared to both rear wheels instead of two motors, one applied to each driving wheel, as is more generally the practice. It does not seem necessary to present any argument in favor of the single motor, as it is obvious that the efficiency of one motor is greater than the efficiency of two smaller motors developing the same aggregate horse power, and also that the maintenance of one motor is less than that of two motors.

The method of mounting and gearing the motor is adapted from street railway practice, the motor being journaled on the rear axle and suspended by a spring arrangement to take up the jar of starting, and relieving the gear from sudden strain. The gear is single reduction, consisting of the motor pinion and axle gear, combined with the usual differential gear to provide for turning corners where one wheel must, of course, travel through a larger radius than the other.

The constructive feature consists in making the axle in one piece throughout its length, one wheel being attached to one of the differential gears and journaled upon the axle, while the other gear is attached to the axle to which the opposite wheel is also attached.

The detail of the running gear is shown in Fig. 3, which is a development of the experimental construction employed in the equipment of the cab shown in the picture. In this machine the motor is of the four-pole type, sixteen inches in diameter, having a maximum speed at full load of 800 r. p. m. and a speed reduction in the gear of 8 to 1. It has been improved in electrical design as indicated by the experience obtained with the cab motor described herein.

The writer believes the future of the automobile and the application of the electric motor thereto to be much greater than has been the application of electricity to street railway propulsion and that the subject of motor design and control is worthy of careful study.

Pacific Cable in Congress.

Messrs. Scrymser and Baylies, of New York, president and vice-president respectively of the Pacific Cable Company; Rear Admiral Irwin (retired) and Mr. F. B. Thurber, of New York, appeared before the House Committee on Interstate and Foreign Commerce last week to urge legislation for the construction of a cable line across the Pacific. The bill they advocated is that introduced by Representative Sherman, of New York, to provide for telegraphic communication between the United States, Hawaii, Guam, the Philippines, Japan and China. The bill proposes to award the contract for a transpacific cable to the company making the best responsible bid, the cable to be constructed and in operation to Honolulu by July 1, 1903, and to Manila and Japan by July 1, 1904. The government is to pay the company $400,000 per year for 20 years in lieu of charges on government messages, and after that time government messages are to be transmitted at not more than one-half the rates for ordinary messages, which are not to exceed 33 cents a word between the United States and Honolulu, or $1 per word between the United States and Manila, China or Japan; press messages are to be charged not more than one-fourth these rates.

Representative Corliss, of Michigan, has introduced a bill proposing to have the transpacific cable constructed and operated by the government, and authorizing contracts for its construction at not to exceed $8,000,000. The arguments of Mr. Scrysmer and the others who appeared were largely directed against the government ownership and operation of the proposed cable. Mr. Scrymser contended that it would cost at least $25,000,000 to construct the line, instead of $8,000,000, as proposed by Mr. Corliss.

The committee adopted resolutions calling on the secretaries of war and navy for full information regarding the proposed cable and the amounts of money that have been expended in cabling to Manila and other Asiatic points by way of the present cables via Europe. January 23 was fixed as the date for hearing government officials on the cable. It is probable that the majority will vote to report the Sherman bill.

The senate committee on naval affairs has fixed a hearing for this week for reports of the war and navy departments on the subject.

Parallel Operation of Direct-Coupled Alternators.

BY W. L. R. EMMET.

The purpose of this article is to explain a principle which is of primary importance in the proper parallel operation of engine-driven alternators and which seems to be new to the literature of the subject. The theory was explained and its practical results verified by the writer about a year and a half ago, but nothing concerning it has ever been published. The principle has been applied with uniform success in many important installations, but still seems to be generally disregarded both by the builders of engines and of dynamos.

The existing literature on this subject all seems to indicate that the troubles of parallel operation must be prevented by special design of the dynamos; while the practical applications of the principle above mentioned have amply proved that the engines are the real source of trouble, and that any two or more dynamos of equal frequency and voltage can be successfully run in parallel if the engines are properly fitted in the manner described below.

The serious trouble with paralleled engine-driven alternators has been a tendency to oscillations in the relative motions of the machines, which oscillations are naturally accompanied by periodic cross currents. In some cases the amplitude of these oscillations are limited in extent, while in others their force is liable to accelerate with more or less rapidity until the machines drop out of step. In some machines under certain conditions a sort of unstable equilibrium may exist by virtue of which they may run steadily in parallel for considerable periods and suddenly be upset by some change of conditions when oscillations will begin which may throw the machines out of step in a few seconds.

These oscillations are in their nature similar to the swing of a pendulum. Each machine with its fly wheel and other attachments is a heavy moving mass and these masses are held in the synchronous relative position by the magnetic fluxes which are controlled by the currents interchanged between the machines. The action of this force upon the relative motion of the machines is similar to the action of the force of gravity upon the pendulum, and we thus have a system capable of vibrations of relative motion. The period and character of these vibrations are influenced by the moments of inertia of the masses involved and by the synchronizing force of the dynamos, which force is influenced by the armature reactions, self-inductions and other electrical peculiarities.

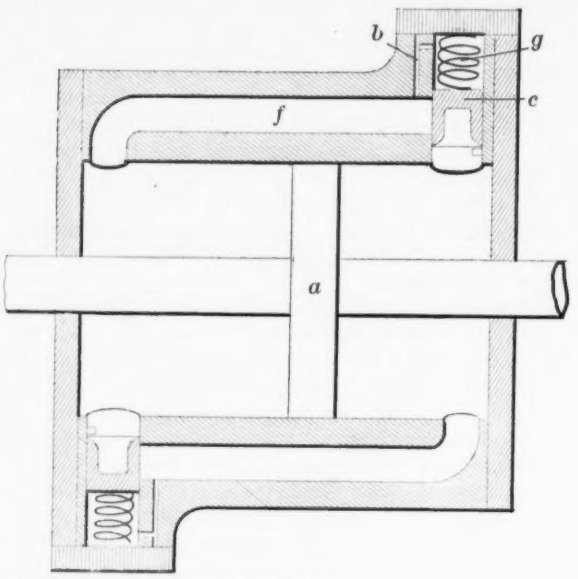
The parallel-running dynamos do not, however, constitute a free vibrating system like a frictionless pendulum, because there is friction, both mechanical and electrical, to be overcome. The variations of relative positions cause shiftings of flux distribution which generate power consuming currents. Among those who have tried to design dynamos with a view to overcoming this trouble, some have varied the weights and synchronizing forces so that the relative periods of vibration would not conform to any combination of engine impulses, while others have adopted polar attachments or windings in which currents are generated by the shiftings of flux, and which so introduce a sort of electric friction which tends to stop the oscillations.

None of the writers on this subject seem to have sought the actuating force which keeps these vibrations alive. A clock pendulum does not continue to swing unless it receives a push from the escapement in every vibration, and we are naturally led to inquire where the impulses come from which maintain these oscillations between the dynamos.

By such a course of reasoning the writer has been led to the belief that these impulses come from the steam, and that they are caused by the relative actions of engine governors which, in their efforts to compensate for the speed vibrations, cause a periodic delivery of steam which keeps these vibrations alive. Just as the clock escapement, while moved by the pendulum, breaks the force into impulses which keep the pendulum swinging; so the governors, actuated by the oscillations of rotary motion, admit the steam by jerks and so keep those oscillations alive.

After this theory was formed it was fully verified by observations of governor action and by comparisons of successive indicator cards under various conditions.

This cause of trouble being decided upon, it was obvious that the cure lay in the use of dash pots which would sufficiently retard governor movements to prevent an appreciable change of valve within the period of each oscillation. As soon as this remedy was applied it was found to be completely successful in two very important installations where much trouble was experienced. Stable parallel operation was attained in both cases by the use of



SECTION OF DASHPOT.

simple dashpots which were not stiff enough to seriously affect the speed control of the engines. The experiments in one of these cases, however, led to a very valuable suggestion from Mr. Harte Cook, who proposed that dashpots should be so designed that they would powerfully retard for a brief period any motion of the valve mechanism, but would freely yield to continued pressure such as is imposed by change of load. One of Mr. Cook's designs for such a dashpot is illustrated by the accompanying sketch. Its action needs little explanation. The spaces around all the pistons and in all the ports shown in the sketch are filled with grease. When the main piston, *A*, is first subjected to pressure through the rod it imparts motion to the piston *C*, and this motion is limited in speed by the flow of grease through the small port, *b*. When the pressure is continued for an appreciable time the piston *C* is forced back until its edge uncovers the port, *f*, which affords a free bypass for the grease so that the piston, *A*, can promptly take a new position without further impediment. After the poston, *A*, has taken its new position the spring, *g*, forces back the piston, *C*, till it covers the port, *f*, so that short, quick motions are again prevented.

Experience in many cases seems to indicate that engines having governors properly fitted in this way cannot give trouble through oscillations while operating in parallel, and that this result can in every case be accomplished without impairing the normal action of the most sensitive governor.

The oscillations of engine motion here referred to should not be confused with the natural variations which are caused by normal irregularity or crank effort, although these natural variations, of course, have a tendency to start the other trouble where the conditions are such that it can exist.

An Important Patent Decision.

BY ARTHUR F. KINNAN.

An unusually important decision has just been rendered by the United States Court of Appeals for the District of Columbia, in the case of Bechman vs. Wood. As the decisions of this court do not appear in any of the court reports, a critical analysis of the decision will be of more than passing interest to persons interested in patents.

The state of facts upon which the decision is based is as follows:

Wood filed an application for a patent, presenting therewith a claim of invention limited in its scope. Two years later Bechman filed an application for a patent disclosing a machine which, while it was specifically different from Wood's, accomplished the same result in an equivalent manner, and accompanied his application with a claim of invention so broad in its scope as to read equally well on Wood's device. A year after Bechman's application was filed Wood made a claim similar to Bechman's. A contest was instituted in the Patent Office to determine which party should be allowed to have the broad claim in his patent. All the tribunals of the Patent Office having jurisdiction of the contest successively decided that Wood was the first inventor, and therefore entitled to the broad claim in controversy. Thereupon Bechman appealed to the Court of Appeals.

The court found no difficulty in deciding with the Patent Office that Wood was the first inventor, but made the novel holding that neither party was entitled to the broad claim in issue—holding that Bechman could not have it, for Wood invented its subject-matter first; and that Wood could not have it because he did not present the claim until after Bechman had presented it.

It is common practice for the defeated party in a contest for a broad claim of invention to oppose in every possible way the granting of a patent containing the broad claim to the successful party. When a party has lost, he usually pleads that his own device does not fall within the terms of the claim, or that the successful party has no right to make the claim, or that the claim is not patentable. All these pleas were made by Bechman and were overruled.

The reason advanced by the court for denying the broad claim to the first inventor, viz.: That he did not claim it in his application until after the later inventor had done so, was not hinted at even remotely by counsel for Bechman, and was never before presented in any reported case. The court on its own motion went outside the matters presented by counsel and based its reasoning on the well-known and leading cases of Railway Co. vs. Sayles, 97 U. S., 554, and Topliff vs. Topliff, 146 U. S., 156, and which cases were not cited in the brief of either party.

A motion for rehearing was heard, and in view of the importance of the case, the court allowed the Commissioner of Patents, through his law clerk, and a prominent patent lawyer, as *amicus curiae*, to file briefs in opposition to the decision.

The cause of the errors of the court was not pointed out nor touched upon in any of the briefs or arguments, which were confined to an attack upon the errors themselves, with the result that the court, not having had the reasons for its errors disclosed, sustained its former ruling.

The real cause of the errors is to be found in the fact that the court of its own motion invaded a field of special law without the aid or enlightenment of counsel skilled in the technicalities of such law. To words which have acquired peculiar and special significance in the law of patents, the court gave their ordinary and popular meaning, and thereby came to a conclusion which is unprecedented, inequitable and in violation of the federal patent laws. The finding of the court was a clear and logical deduction from the Supreme Court decisions cited by it in support of its position when it had in mind the language of the decisions as such language is frequently or commonly used.

The court reasoned, first, that Wood was estopped from making his broad claim because of the "intervening right" of Bechman, Bechman having made the claim first; and second, that it was not competent for Wood, having at first made a narrow claim, to "enlarge his original specification to interfere with other inventors who have entered the field in the meantime." It therefore decided that Wood, although the first inventor, could not have the claim.

The first error of the court in holding that Bechman had an "intervening right," arose by reason of the court confusing a mere

application for a patent with the patent itself, which confusion has been before known to occur in federal courts.

The "rights" of an inventor are purely statutory. He therefore has no "rights" whatever in his invention other than the statutes give him. The Revised Statutes provide (Sec. 4886) that, under certain conditions, if a person has made an invention, and will properly describe it (Sec. 4888) so that the public can reproduce it, and properly claim it, so that the public may know exactly what parts of all that which is disclosed they are not free to use, the Government will then grant him a right, and make that right patent by publishing it under the seal of the United States. An inventor's rights begin only with the date of his patent. He cannot treat any act that occurs before that date as an infringement of his rights.

An application for a patent is no more and no less than a mere secret preliminary proceedings between two parties to a future contract, the Government offering to grant a monopoly for seventeen years in exchange for a new invention properly described and claimed. No "rights" accrue to either party until the contract is signed, sealed and delivered. The moment an application for a patent is filed a discussion at once arises as to the terms of the future contract, i. e., as to the breadth or scope of the claims. The only limitations that can be placed upon the inventor are that his invention must be clearly described, and that his claims must be patentable and must read on his invention as he disclosed it to the Government when he filed his application. It is perfectly immaterial at what time during the progress of the discussion of the future contract the applicant presents a claim commensurate with his invention, or what induced him to present it. If his claim reads on his invention, it will be allowed to him, to form a part of his "rights" when it appears in his patent.

Congress anticipated the fact that two or more persons might make claim to the same invention and provided (Sec. 4904) that under such conditions a contest should be instituted and a patent awarded only to the first inventor. This was the case with Wood and Bechman. Wood proved priority and under the law should have had the claim. When Bechman filed his claim he had no right to it whatever. He took his chances on its being patentable and on his being the first inventor of it, and was merely asking the Government if it would, at some time in the future, give him the right to it; i. e., give him a patent containing that claim.

The court in speaking of the "intervening rights" of Bechman cites Topliff vs. Topliff and other leading decisions, all of which relate to the reissue of patents, and which cover an entirely different state of facts, and are governed by totally distinct and independent statutes.

The "intervening rights" alluded to in the Supreme Court decisions, all refer to rights which the public has acquired between the time of the granting of a patent, and the time of the granting of a reissue of the patent.

When a patent is granted, the contract signed, sealed and delivered, it is published to the world with presumptive notice that the people in the United States are not to infringe the claims thereof. Any person is obviously at perfect liberty, as far as that patent is concerned, to make, use and vend anything that is disclosed in the patent but not claimed therein. Sec. 4916 provides that a patent may be surrendered and reissued if some mistake was inadvertently committed in issuing the original patent. The Supreme Court has uniformly held, however, in the decisions cited by this court, that a patent cannot be reissued to include matter not within the scope of the claims of the patent, if the public on seeing the patent and before the reissue was granted had availed itself of the matter not claimed. This use by the public, or a single member of it, of matter disclosed but not claimed in a patent, if such use occurred before the patent is reissued, is in patent law technically called "intervening rights." When a patent is granted and published to the world, the public has, under the statutes, a right of way, as it were, across the patent, provided it keeps outside of the boundaries fixed by the claims. If the patentee discovers that the boundaries have been inadvertently improperly fixed, he may surrender his patent and get a reissue in which the boundaries are correctly established, provided always that he changes the boundaries before the public has actually occupied its right of way, or before the rights of the public have intervened.

The court in its decision has simply used the language of the Supreme Court in discussing the "intervening rights" of the public to matter not claimed in a patent, and has applied that language to an application for a patent without any change, adaptation, or reasoning to show any analogy between the two. It has taken language which very properly applies to a public patent with its boundaries fixed and its rights established, and defined by certain laws, and has applied that language to a secret request for a patent, and in which request the boundaries shift like the sands of the sea up to the very moment of a final granting of the request, and which request is prosecuted under other and totally dissimilar statutes.

Bechman and Wood, under the statutes, possess no rights of any kind, but are mere claimants for the grant of a future right and are before the government for the very purpose of having the boundaries of their claims settled before a right is granted to either of them. To apply to their cases, which are in a chaotic condition up to the time their patents are issued, the laws which control the relations which exist between a patent and the public is obviously an error, and that is exactly what the court did, and did it in the face of the dicta in its own decision in the case of Christensen vs. Noyes, 90 O. G., 227, decided a month prior to the decision under discussion, and in which it said "while Congress has prescribed the mode by which the exclusive right of an inventor in his invention may be secured, yet there is no property right in such invention until a patent be issued therefor."

Turning now to the second ground advanced by the court for refusing the claim in issue to Wood, although he is the first inventor the court, quoting Railway vs. Sayles, holds that it is not competent for Wood, having first made a narrow claim, to enlarge his original specification to interfere with other inventors who have entered the field in the meantime. Here the court has given the words "enlarged his original specification" their commonly accepted meaning, when after decades of use in the patent law these words have come to have a special and unusual significance.

When an inventor files with the government his request for a patent, the only limitations which under the statutes can be imposed on him are, that the invention must be patentable, that it must be fully described, and that it must be properly claimed. An inventor does not invent a claim, but he invents a thing. The claim is merely a statement in language of what the inventor considers the novelty in the thing to be, and the claim will be varied in scope as circumstances demand, to correspond with what the government and the inventor shall agree is actually novel. If he has invented something totally new he may claim "means," for accomplishing the desired end, and if a patent is granted to him he can treat as an infringement of his patent right any other means which accomplishes the same result in a substantially equivalent manner. The language of his claim can obviously be as broad as his actual invention, and is only limited by it. He cannot under any conditions extend his claim beyond his invention. It has, therefore, been the universal and just practice of the patent office and of the courts, of which the case of Railway Co. vs. Sayles is a leading case, to hold an inventor's actual invention to be fully disclosed when he first files his application, and thereafter to permit him only to amend one part thereof by another. If his drawing clearly shows a feature not described and claimed he may, under proper oath, amend his specification to describe and claim it. Or if a feature is clearly described but not illustrated or claimed, he may in like manner illustrate and claim it. But when the patent issues, every claim must cover no more than was originally disclosed in the application as first filed. If any matter, not originally disclosed, however trivial, has been inserted in the description and included in the claim, the specification is known in patent law parlance as "an expanded specification," and the claim is very properly declared to be invalid. An inventor, if allowed to introduce matter into his application which he had not originally disclosed, could on seeing some improvement on his machine made by another, at once amend his application to interfere with the rights of the public or with the rights of another party, which he could not do if he were permitted to only claim what he originally disclosed. Whether the application is the first or original application, or whether it is an application for a reissue, the same rule holds, the claim must not be broader than the invention originally disclosed, the specifications must not be "expanded." The facts which form the basis of the rule are perfectly apparent upon a careful reading of the decisions referred to by the court in deciding this case, and the rule cannot by any legitimate construction be applied to a claim which reads directly on the invention as first disclosed. The court has, however, applied the term "expanded specification" to Wood's case when Wood has merely made a claim in his application, commensurate with his exact invention as it was fully and originally disclosed, exactly as the statute requires him to do.

The court has clearly made a decision in this case which is not supported by law or countenanced by equity, and as it is an appellate court of last resort it places Wood in a most peculiar situation. He has no appeal. A motion for a rehearing has been denied. He has made an invention and been decided to be the first inventor, but is denied a claim to his invention which the statute says he must make, first, on the ground of the "intervening rights" of the other party, when the other party has no rights whatever; and second, on the ground that his "specification was expanded," when his specification contained nothing but what was originally disclosed. If the Supreme Court of the United States will not grant a writ of certiorari, Wood's remedy is by a bill in equity (Sec. 4915), an expensive and arduous undertaking, but apparently the only one available.

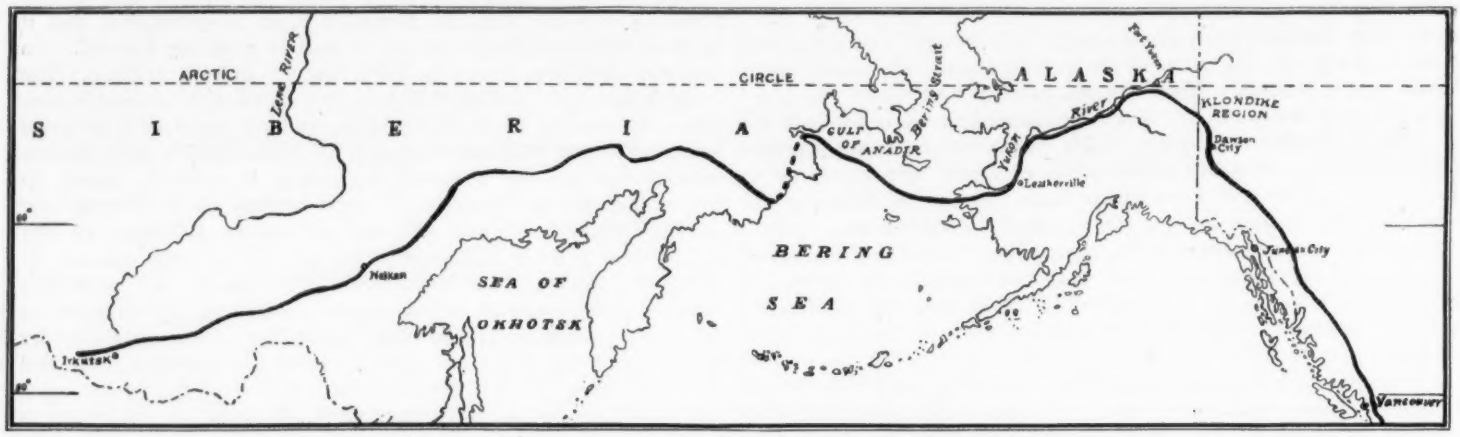
Transpacific Telegraphy: An Alternative Route.

BY F. R. G. S.

NOW that the question of transpacific telegraphy is so much in evidence and the advocates of the two submarine cable schemes, the one from Vancouver and the other from San Francisco to the Far West, are each in turn bidding for the financial support of their various governments and colonies, it may not prove uninteresting to inquire into the prospects and intentions of another alternative route that of late has made considerable progress in a quiet and unambitious way. I refer to the Northern Commercial Telegraph Company, otherwise the 61st Victoria, Chap. III., as it appears on the Statute Book of the Imperial Parliament. This company's charter empowers it to construct a line of telegraph from the American boundary north through British Columbia via Dawson City to the boundary of Alaska; thence the Northern Commercial Telegraph Company of America, a concern working in accord with the English company, will continue the line, taking it through Alaska via Cape Nome to Bering Straits.

A little retrospect is here necessary. In the late sixties when the first Atlantic cable projected by Mr. Cyrus Field had signally failed, and when even to that dauntless pioneer in submarine telegraphy it seemed doubtful that he and his colleagues would succeed in their attempt to link the two continents by way of the Atlantic, the governments of America and Canada voted a sum of $500,000 for the purpose of exploiting the land route to Europe via Bering Strait and Siberia. In the following eighteen months, and pending the completion of the first Atlantic cable, a good deal of solid work was done, signs of which remain to this day. Where necessary, a track fifty yards in width was cut through the forest and some hundreds of tons of telegraph wire were deposited along the route, the greater portion having apparently been landed at Telegraph Creek, at the head of navigation on the Stikine River, where to this day a large heap of it remains all welded together by rust. It looks moreover as if it had not been galvanized. The line it was then proposed to follow, up the Fraser River, along the western side of the Babine Mountain and Lakes across the Skeena at Hazleton and on by Telegraph Creek and Teslin to the Yukon, is practically the same as that now being constructed by the Northern Commercial Telegraph Company. But under what different conditions! In 1869 nearly all this country stood on the maps as "unexplored." In 1900 a good trail has been made by the government as far as the Yukon River, many settlements have been established along the route, and thousands of prospectors overrun the country during the summer. In 1867 Europe was the sole objective point, and eight thousand miles of wire had to be erected in America and Siberia before that point could be commercially reached. Now the line is self-supporting for nearly the entirety of its length. The riches of the Klondike and Alaska have attracted thousands of inhabitants, and a prosperous trading, banking, shipping and mining community has come to stay. Alaska is probably to-day the richest in easily won gold of any territory upon the globe. The conditions of life are there so abnormal in regard to communication by mail with the outside world, and moreover can never be much improved, that an adequate telegraph service is indispensable. The discoveries at Cape Nome will more than double the present population by next year, and Alaska has now become a quantity that the United States government can no longer neglect. Nor does it show signs of so doing, for a governor has been appointed and several stations for troops, custom houses, etc., have been located.

So far as to the commercial aspect of this route. The physical difficulties to be overcome, while not to be despised, are nevertheless of no great account. Transportation of wire and materials is the most important; next the placing of poles in ground that is always frozen in summer two feet below the surface. In regard to the former, two navigable rivers, the Skeena and the Stikine, are crossed in the first 1000 miles, and much lessen thereby the labors of transportation. The remainder of the way lies along the Yukon right away to St. Michaels. A substantial line is being provided for, carrying two wires for the first year. In regard to wire, a special class of No. 9 B. B. is being used. It is a brand that was adopted by Sir William Henry Preece, F. R. S., of the English Telegraph Department, after long testing. It is called by him "Post Office Colonial," and while nearly double the price of ordinary No. 9, it is capable of doing 40 words per minute both ways (duplex) and is specially adapted for extremely cold climates. This wire is made only in England; a quantity of it has already been delivered, and it seems to fulfil all that is claimed for it.



MAP OF ALTERNATIVE ALASKAN LAND ROUTE TO PACIFIC CABLE.

In comparing the economical positions of the submarine and land routes, the advantages possessed by the latter are shown in strong relief. First, in regard to capital expenditure. The cable from Vancouver to Australia is estimated by the Canadian government to cost $18,000,000, and that from San Francisco to Manila $14,000,000. The land line from Vancouver to St. Michaels with its various branch lines to Cape Nome, Juneau and other places, cannot cost more than $1,000,000. In annual maintenance charges the balance in favor of the land line is equally striking, for it will be necessary to keep one or more cable ships constantly in commission, and in the event of a breakdown the cost of repair and loss of time and business consequent on it is of course very large. A large annual sinking fund will also have to be considered in the case of the cable. The land line, on the other hand, can be efficiently maintained for at least two-thirds of its length from the paying stations on its route, and any break located and repaired within twelve hours at the most. The remainder of the line will for a time have to be maintained somewhat on the plan of the overland route through Persia to India. In this case there are way stations about every 60 miles, in each of which two or three men are placed, whose duty it is to test the line every day, and in case of necessity go out and repair it. This method is adopted by the Siberian line, and no difficulty has been

found in keeping open connection all through winter under conditions that are exactly similar to those in Alaska. Once across the straits, communication is made with the Great Northern of Siberia, which company has only about 400 miles of construction to complete. and the last link is closed.

I have endeavored to show that there is every probability that before the end of 1901 the vast trading interests of this country with China and Russia will be adequately provided with a telegraph service independent of the submarine. From the small amount of capital to be expended upon it in comparison with a submarine cable, its tariff should be such that it will greatly benefit the community doing business with the far west, and from its political and strategical aspect in relation to Alaska it is of no small interest to the government of the United States in view of the fact that Canada dominates one terminal.

The "Bedford" Telephone Exchange, Brooklyn.

ATTENTION was directed recently in these pages to the large amount of new work that is being done in Brooklyn by the progressive New York & New Jersey Telephone Company. Not only is the development of the service in that part of Greater New York extremely rapid, but it is accompanied by a bold adoption of the latest methods and apparatus, so that in the "Main" exchange, described in these columns a few weeks ago, we find the largest multiple common battery exchange in the world, with an equipment of the most costly character. The Brooklyn territory is, however, remarkably varied, and while in the "Main" exchange is seen not only the centre for an intensely active business area and for all the miscellaneous population dwelling on Long Island all the way to Montauk Point, 120 miles to the eastward—in the score of other Brooklyn exchanges is embraced a heterogeneous community that would adequately represent any state in the Union. Brooklyn has often been called "the bedroom" of New York, and it is undeniably as huge a residential district as can be found in this country. To furnish telephone service in the sections that include the homes rather than the stores, offices and factories, is the specific task that has devolved on the Bedford district exchange, and yet despite the fact that such territory can hardly ever be made to yield a large income, the New York & New Jersey Telephone Company has installed in that quarter a plant which is virtually in all save size a duplicate of the "Main." It will be very interesting to note how the two exchanges work out their results on their two distinct lines of patronage. At the present moment it is the fact attested by the records, that the establishment of a $24 rate for 300 messages, for a four-party line service, is rapidly increasing the number of Bell telephone subscribers in the Bedford district. The metropolitan householder who cannot afford less than 50 cents a week for telephonic connection with his own neighborhood and half the United States thrown in, must be a rare bird.

The experiment thus being carried out at the "Bedford" exchange is of unusual importance, and we are glad to be able to present herewith a few views of the exchange, which to-day has no fewer than 1450 subscribers. That number alone would justify us in speaking of it as other than a sub-exchange, but the use of that phrase will touch a question of vital importance, as to exchanges in residential districts. In business areas, it is comparatively easy to get a floor in a fine office building or, better, to put up an exchange building of your own. But such facilities do not in reality exist in streets of homes and villas. In this case, as will be seen in Fig. 1, the company has boldly "taken the bull by the horns" and invested in a solid, substantial building for itself, fireproof, and not beset by any insurance hazards on the immediate outside. The switchboard shown in Figs. 2 and 5, on the spacious second or upper floor, is of the multiple common battery type using lamps as signals, built by the Western Electric Company, and has an ultimate capacity of 2800 lines and

FIG. 1.—BEDFORD BELL TELEPHONE EXCHANGE, BROOKLYN.

FIG. 2.—OPERATING ROOM, BEDFORD EXCHANGE.

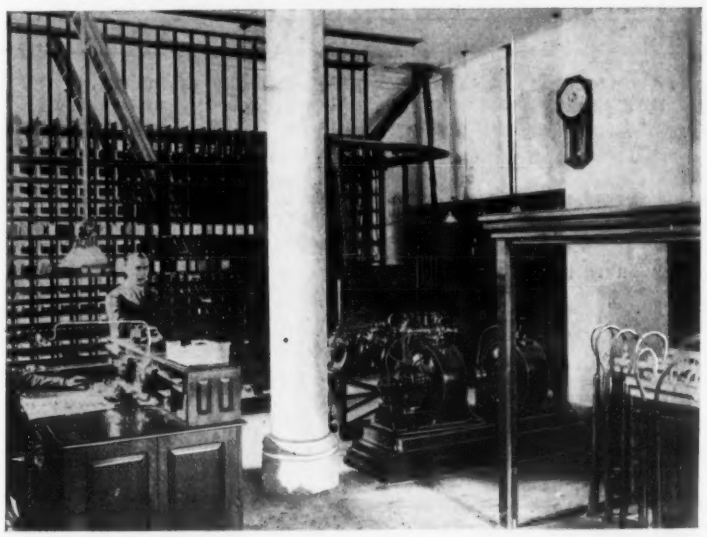


FIG. 3.—GENERATING PLANT.

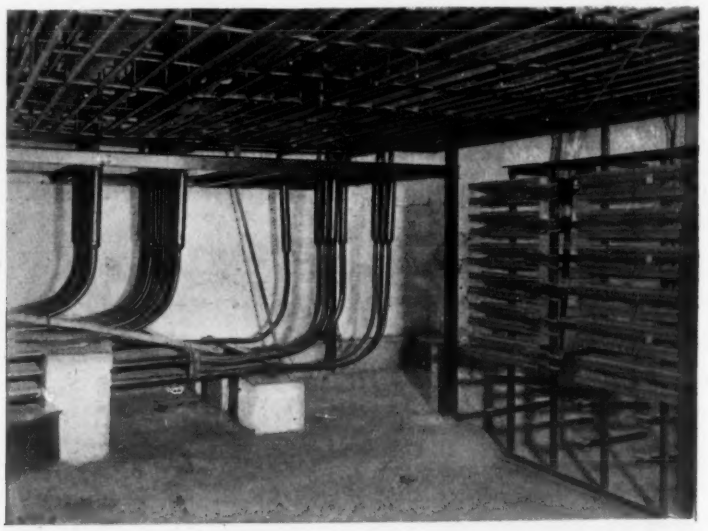


FIG. 4.—CABLE VAULT AND DISTRIBUTING RACKS.

600 trunks. Its present equipment is 1500 subscribers' lines and 170 trunks. Fig. 4 shows the cable vault and the main distributing frame, the latter having a capacity of 6000 lines. No fewer than 33 cables enter the building here.

Careful provision has been made for the continuous operation of the exchange, as indicated in Fig. 3. The storage battery consists of

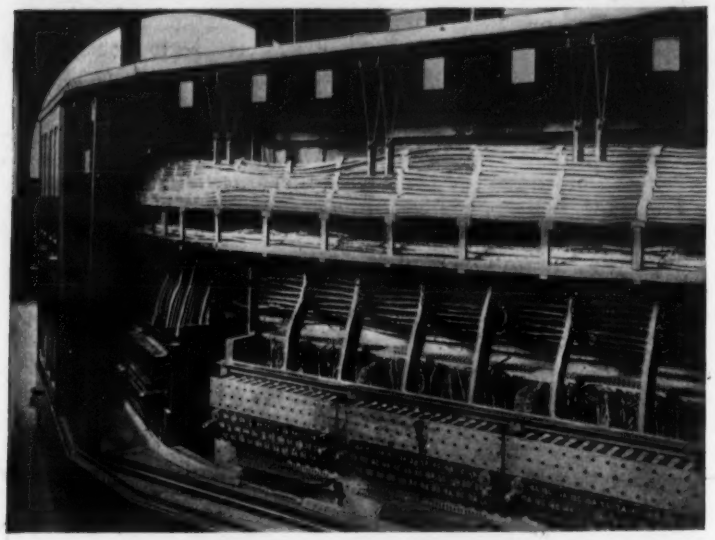


FIG. 5.—BACK OF SWITCHBOARD.

a series of eleven 15 G. Chloride accumulators, with a capacity of 1120 amp.-hours. There are two 7½-kw Western Electric generators for charging this battery. One of them is direct-coupled to a 10-hp 230-volt motor on the Edison circuits and the other is belt-driven by a 10-hp White & Middleton gas engine. The location of the exchange is excellent for its work, it being at the junction of Throop and Decatur Avenues, between Broadway and the arterial Fulton Street.

Projected Cable to Iceland.

Consul Nelson, of Bergen, Norway, reports to the State Department that the projected Iceland cable is interesting all northern Europe. It will be 650 kilometers (403.89 miles) in length, extending between Iceland and the Shetlands. The Northern Telegraph Company, of Copenhagen, has offered to lay the cable under certain conditions. The cost of laying the cable is estimated at $850,000. It is stated that apart from the benefit to meteorology, the cable will also be of particular service to American, English, French and Norwegian fishermen, who carry on their trade on a large scale in the neighborhood of Iceland.

Cost of Arc Lighting.

In a communication to the American Institute of Electrical Engineers discussing the paper read at the September meeting, Mr. H. H. Wait considers at length the cost of arc lighting. In comparing alternating and direct-current lamps, Mr. Wait assumes the following ratings for the sake of comparison, the figures for the candle-power referring to commercial and not actual rating:

Direct current open arc	450	watts at arc	2000 cp
Direct current enclosed arc	450	" " "	1500 cp
Alternating current enclosed arc	450	" " "	1150 cp
Alternating current enclosed arc	400	" " "	956 cp
Direct current open arc	300	" " "	1200 cp
Direct current enclosed arc	300	" " "	900 cp

The comparisons of different arc lamps are given in the accompanying table. In making up the cost, real estate has been taken at 50 cents per square foot as representing a fair value, actual values ranging anywhere from nothing to $7 or $8 per square foot.

Buildings have been taken at $1.50 per square foot, the range in this respect being nearly as great as for real estate.

Boilers, foundations, stacks, pumps, condensers, piping and other accessories have been lumped together at $25 per indicated hp. This item may run as low as $9 and as high as $40 per one hp of engine. It has been increased to $27 per one hp in the engine-driven direct-current arc plants to allow for extra accessories on account of subdividing the units. The engine and boiler items are, of course, interdependent as, when engines are cheap, the tendency is for an increased cost of the boiler plant. The attempt has been made to get an average current market value for all classes of boilers and engines.

Engines and foundations have been figured at $20 per one hp. This figure will run as low as $10 per one hp and as high as $50 per one hp for high-class triple expansion vertical engines. The rate has been increased to $22 per one hp on some of the engine-driven plants to allow for greater subdivision etc.

Alternating current generators and foundations have been taken at $25 per kw as a fair value of what would be put in a modern plant. These figures vary from $12 to $35 per kw.

Direct-current arc generators vary in price from less than $30 to $45 per kw.

Belted arc machines have been taken at $35 per kw and the higher speed motor-driven machines at $33 per kw. Large direct-driven machines would average about $45.

Alternating constant current transformers have been taken at $15 per lamp for both 400 and 450-watt lamps, as there is considerable variation in the accessories to these transformers.

Alternating current inductive regulators have been taken at $9 per lamp. This can be made a very variable item on account of the amount of regulation to be provided for as well as other reasons.

Cost per Lamp per Year of 3800 Hours.	1 Hartford 400 Watt Enclosed.	2 Hartford 450 Watt Enclosed.	3 Alt. C. Ind. Reg. 400 Watt Enclosed	4 D. C. Arc Driven by A. C. Motors, 300 Watt Enclosed.	5 D. C. Arc Belted, 300 Watt Enclosed.	6 D. C. Arc Driven by D. C. Motors, 300 Watt Enclosed.	7 D. C. Arc Belted, 450 Watt Enclosed.	8 D. C. Arc Belted, 450 Watt Open Arc	9 D. C. Arc Direct Connected 450 Watt Open D. C.	10 A. C. Ind. Reg. 450 Watt Enclosed.	11 D. C. Arc Driven by A. C. Motors, 450 Watt Enclosed.	12 Rectifier System, 450 Watt Enclosed.	13 Incandescent 3-50 C. P. Lamps, 450 Watts.
Total cost per lamp	146.50	155.24	139.80	131.42	117.90	129.45	147.37	142.60	142.00	91.14	100.40	154.30	121.75
" " " nominal c. p	.154	.1349	.147	.146	.131	.144	.0982	.0713	.071	.0795	.0669	.103	.81
I. H. P. per lamp	.744	.822	.708	.630	.552	.642	.830	.832	.810	.804	.948	.816	.766
Operating Expenses:													
1. Coal and water	11.85	13.10	11.30	10.05	8.80	10.20	13.25	13.30	12.90	12.80	15.10	13.00	12.25
2. Wages	8.50	9.35	8.07	8.85	7.78	9 00	11.68	11.70	11.40	9.15	13.30	9.30	10.78
3. Superintendent, office, etc	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
4. Int. taxes, ins. 7%. Depreciation, 6% } 13%	19.00	20.20	18.15	17.10	15.30	16.80	19.10	18.50	18.50	11.90	13.20	20.00	15.80
5. Extra deprec. arc dyn	..	..	..	.42	.49	.42	.68	.73	.83	.	.63	..	..
6. " " " lamps	.80	.80	.76	.72	.72	.72	.72	.60	.72	.76	.72	.72	..
7. Repairs, renewals, supplies	1.86	2.26	1.77	1.57	1.38	1.60	2.07	2.08	2.02	2.03	2.36	2.04	1.92
8. Extra repairs arc dyn	..	..	..	.32	.28	.32	.42	.42	.41	..	.47	..	..
9. " " Const. C. trans	.15	.18	..	..	..	..	..	..	..	.	..	.48	..
10. Trimming	5.20	5.86	5.20	2.60	2.60	2.60	3.15	Daily 11.00	Alt.d'y. 6.50	3.15	3.15	3.15	2.00 Insp't'n
11. Carbons	1.90	2.30	1.90	1.40	1.40	1.40	1.70	7.50	6.80	2.30	1.70	1.70	..
12. Globes	1.60	1.80	1.60	1 00	1.00	1.00	1.30	.70	.50	1.80	1.30	1.30	16.10 R'n'wls
Total operating expenses	52.86	57.85	50.75	46.03	41.75	46.06	56.07	68.53	62.58	45.89	53.93	53.69	60.85

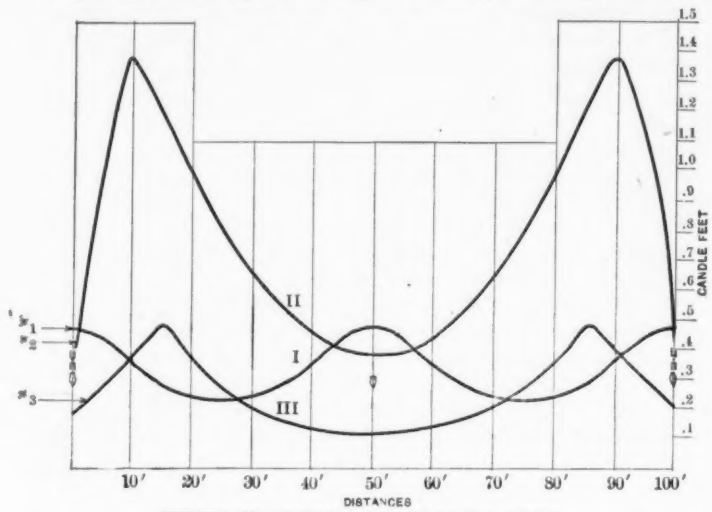
The figure is intended to cover a regulator to control the entire circuit.

The line has been figured at $51.10 per lamp for the 300-watt enclosed direct-current lamp. This figure was based on the use of hard-drawn copper wire with weather-proof covering and the ordinary pole and suspension construction such as would be used in small towns or the outlying districts of cities. The size of wire for the other systems has been increased as nearly as possible in the ratio of the current, the other conditions remaining the same. It will be noted that an increase in the cost of this line construction will add a fixed amount to the investment and operating expenses, and will not affect the absolute differences between the systems. The percentage difference will vary, however.

The line and pole work such as is used in large cities will run from $100 to $150 per lamp, while underground cables and conduits will run from $200 to $300 per lamp.

In estimating operating expenses, coal and water have been figured at .42 of a cent per one hp-hour. The values vary from .28 of a cent per one hp to .76. .42 of a cent per one hp-hour corresponds with .7 of a cent per kw-hour with 80 per cent. combined efficiency for engine and dynamo.

Wages have been figured at .15 of a cent per one hp-hour in the



CURVES OF COMPARATIVE ILLUMINATIONS.

boiler room; the same in an alternating current dynamo and engine room, and at .22 of a cent in the arc dynamo room.

The superintendence and office expenses have been figured at $2 per year per lamp in all cases, as this will not vary materially with the kind of plant used.

Interest, taxes and insurance are figured at 7 per cent.; depreciation at 6 per cent.; this depreciation factor might more strictly be called replacement, as it is intended to include not only real depreciation, but also a factor for replacing machinery caused by competition with improvements. A sum at compound interest at 6 per cent. would equal the original in eleven and one-half years, so that this would seem to be large enough. Extra depreciation on arc dynamos and arc lamps has been placed at 4 per cent. This makes a total of 10 per cent. for the replacement factor on these portions of the plant. This would cover complete replacement in a little over seven years.

The general repairs, renewals and supplies have been taken at .07 of a cent per one hp-hour. Extra repairs on arc dynamos have been taken at .015 per one hp-hour. It might be remarked that in several modern arc plants, of which the figures are at hand, this value is considerably less. Extra repairs on alternating constant current transformers has been placed at .007.

The figures for trimming arc lamps have been taken from the data of the plants at hand. In some cases the cost is less than half the values used. In other cases the cost for trimming runs up nearly double the values taken, and may vary from $1 to $6.25 per lamp per year for direct-current enclosed lamps of 400 to 450 watts. The difference comes mainly in the time spent in cleaning the inner globes and in the price of labor as well as the number of lamps taken care of by a man. The figures on enclosed lamps are such as would allow the globes to be kept fairly clean, and the cost of trimming alternating enclosed lamps has been increased by a small factor on account of the practice which obtains in some stations of cleaning the globes of these lamps oftener than the direct current lamps under the same conditions.

The alternating lamps consume their carbons faster than direct current lamps partly on account of the increased wattage and partly on account of the almost universal practice of using one cored carbon. The use of the cored carbon also materially increases the blackening of the globe. In column 10 the 450-watt alternating lamp is assumed to have solid carbons, and has the same cost for trimming as the direct-current 450-watt lamp. The cost for globes was taken in the same way as the trimming cost.

The life of incandescent lamps has been taken at 600 hours and the cost of the lamps 85 cents. An allowance of $2 per year each three lamps has been made for inspection and cleaning.

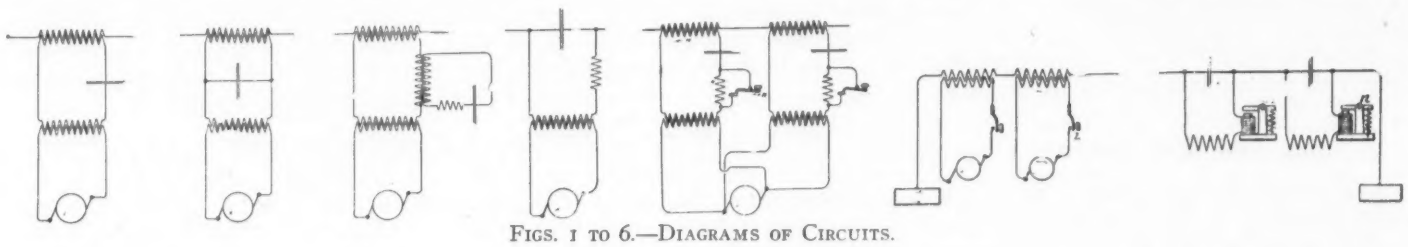
The paper of Mr. Wait also includes a number of curves of illumination. One of these shown in the accompanying figure, gives a comparison of illumination at short distances, such as would occur in the business district of a city. Curve I represents the illumination from six 50-cp incandescent lamps, taking a total of 900 watts. These are located in clusters of two, 50 feet apart and 15 feet above the street. Curve II represents the illumination from two enclosed direct-current arc lamps of 450 watts each, placed 100 feet apart and 16 feet high. Curve III is for two alternating-current enclosed lamps with opalescent inner globe, the lamp taking 327 watts at the arc, and being suspended 18 feet above the street.

The mean ordinates are .35 for the incandescent lamps; .76 for direct-current enclosed lamps, and .28 for the alternating-current enclosed lamps. The relatively poor showing of the alternating-current lamps in this case is partially due to the low efficiency of such lamps and partly to the fact that their light is more concentrated near the horizontal plane. Reflectors on the lamps and reflection from buildings would bring up the showing in the alternating-current lamp considerably.

Electrical Transmission and Distribution With the Use of Condensers.

It is well known that if an inductance and a condenser be placed in series, a higher e. m. f. may be obtained at the terminals of either than the e. m. f. impressed at the terminals of the series circuit; and also, that if a condenser and inductance are arranged in parallel across a line, a current may flow in the parallel circuit larger than the current in the main line.

Prof. M. I. Pupin has applied these two principles to the transmission and distribution of electrical energy, and the resulting systems form the subjects of two patents issued January 2d, one of which relates to "stepping up" e. m. f., and the other to "stepping up" current. In the first patent the diagram given (Fig. 1) showing the essential elements of the invention, represents two transformers, one in inductive relation with the line, the second connected with a generator, and the other winding of each transformer



FIGS. 1 TO 6.—DIAGRAMS OF CIRCUITS.

forming part of a common circuit. In this common circuit is placed a condenser in series.

Another diagram (Fig. 2) shows the condenser in shunt with the common circuit. In another (Fig. 3) a transformer is in the common circuit, its second winding containing the condenser. Still another diagram (Fig. 4) represents the circuit with but one

transformer between the generator and the line, the condenser in this case being placed between the points where the transformer connects with the main line. Some of the diagrams contain an auxiliary inductance coil in the common circuit as in Fig. 4, and a key by means of which this coil may be shunted, as in Fig. 5.

The capacity and inductance in each case are so adjusted as to form a resonance circuit. It is stated that it is preferable, and to a certain extent indispensable, to employ transformers (coils) without iron cores; and that by carefully avoiding the damping effect of iron cores, it has been possible by this system to increase in the secondary the impressed e. m. f. over fifty times without using a larger number of turns in the secondary than in the primary coil.

The system may be employed to obtain several e. m. f.'s of different frequency from the same alternator. This may be done by connecting the alternator (Fig. 5) to two transformers, the secondary circuits of which act inductively upon a common conductor. One of these secondary circuits is tuned to the fundamental frequency of the alternator and the other is tuned to one of the stronger upper harmonics. If the machine be constructed in such a way as to give an e. m. f. rich in an upper harmonic, there will thus be obtained two e. m. f.'s and two frequencies from the same machine.

It is stated that a characteristic feature of this system is that the main conductor forms a complete electrical circuit even if all exciting circuits be broken; and that the exciting circuits are independent of each other in the sense that they are electrically related to the main line by entirely independent elements, and therefore no change in the electromagnetic constants of one, however great, will produce any change in the constants of any other. This latter is claimed to be a very important feature in electrical multiple signaling to which the system is mainly applicable, and in which each transmitting station must be operable independently of the conditions existing at the other stations, and whether they are in operation or not.

The diagram (Fig. 6) referring to the essential principles of the second patent for "stepping up" current, shows at the transmitting end of the line two generators in inductive relation with the line, which impress on the line two e. m. f.'s of different frequencies. At the receiving end of the line two translating devices are connected to the line, a condenser being located between the two points at which the translating device is connected to the line; in series with the translating device there is also an inductance. The two translating circuits may be so adjusted that in one there will be a current with a frequency of 150 and in the other a current with a frequency of 250, should these be the fundamental and secondary frequencies of the generator. Theoretically, any number of such devices may be employed at the receiving end of the line, all being made resonant by a proper adjustment of their electromagnetic constants to one or the other of the periodic currents impressed on the line at the transmitting end.

The conditions upon which the effects stated depend are as follows: First. The capacity of the condenser and the inductance of the shunt coil must be so related as to bring the shunt coil in resonance with the line current. Second. The shunt coil should either contain no iron at all or if it contains iron the quantity of it should be very small, and it should be well laminated and not form a closed magnetic circuit. Third. The ohmic resistance of the shunt circuit should be as small as possible and certainly smaller than the resistance of the line.

The term "resonance circuit" as used in the patent, is defined as a circuit "which has self-induction and capacity, and therefore a natural period. When the self-induction and capacity are properly adjusted so as to give it the period of the impressed e. m. f., the resonant circuit becomes resonant to this e. m. f."

The Dana Greene Obsequies.

To the details that were given in these columns as to the circumstances attending the death of Mr. and Mrs. S. Dana Greene by drowning in the Mohawk River at Schenectady, there is nothing to add that can throw light on the sad accident. All that will ever be known is that they had a skating sail up, and going all too swiftly before the wind, must have plunged headlong into a cutting, as to which they had been warned, and where there was but seven feet of water.

The funeral took place at Schenectady on Jan. 11 and was attended by mourners from all over the country, including Governor Roosevelt and his staff and National Guard officers. The bodies of Mr. and Mrs. Greene were viewed by friends at their late home during the morning. They were in plain coffins covered with black broadcloth. In the right hand of Mr. Greene was a small picture of his wife, which he had carried for several years. The coffins were surrounded with flowers. A short service of prayer was conducted at the home at half-past twelve o'clock, and then the bodies were escorted to St. George's Episcopal Church by Company E, Second Regiment, and a detachment of the First Naval Battalion, under Lieutenant Andrews.

The pallbearers were Captain J. W. Miller, commander of the Naval Militia; Charles A. Coffin, president of the General Electric Company; Joseph P. Ord, second vice-president; W. L. R. Emmet, Hinsdale Parsons, Howard C. Levis, R. S. Sloan and Douglass Campbell, of New York; James Redfield, of Utica; the Rev. J. Russell Stevenson, of Schenectady; C. Whitney Tillinghast, of Troy, and Arthur Clark, of Batavia. The ushers at the church were Messrs. Hamill, Potter and Stebbins.

Among those who attended the service in the church were over 200 friends of Mr. and Mrs. Greene, including officials of the General Electric Company. A special train over the New York Central from New York brought a party of over sixty, including F. P. Fish, C. T. Hughes, A. D. Page, W. G. Whitmore, J. W. Howell and E. H. Mullin, of the General Electric Company; W. S. Howell, secretary of the Association of Edison Illuminating Companies; Luther Stieringer, electrical engineer of the Pan-American Exposition; W. S. Barstow, electrical engineer of the Brooklyn Edison Company; W. H. Johnson, Philadelphia Edison Company; M. J. Insull, vice-president of the General Incandescent Arc Light Company; J. H. McGraw, editor of the *Street Railway Journal*; C. W. Price, editor of the *Electrical Review*; T. C. Martin, editor of the ELECTRICAL WORLD AND ENGINEER; F. J. Sprague and Alexander Henderson, of the Sprague Electric Company; R. W. Pope, C. O. Mailloux, W. J. Hammer and Dr. C. T. Hutchinson, representing the American Institute of Electrical Engineers; Major F. Norton Goddard, Captain Craig Wadsworth and First Lieutenant R. K. Prentice, of Squadron A, New York Cavalry, and Joseph Barre, of New York. Messrs. Barstow and Johnson represented the executive committee of the Association of Edison Illuminating Companies. In addition to these at the church were Brigadier General Griffin, first vice-president; E. W. Rice, Jr., third vice-president; H. W. Darling, treasurer; M. F. Westover, secretary, General Electric Company; G. E. Emmons, general manager; A. L. Rohrer, electrical superintendent, and J. R. Lovejoy, manager supply department, Schenectady works; J. R. McKee, manager power and mining department; B. E. Sunny, Chicago office; W. C. Fish, manager Lynn factory; C. B. Davis and F. M. Kimball, Boston office, and L. O. Weber, secretary to Mr. Greene. C. R. Huntley, past president, represented the National Electric Light Association.

The services at St. George's were conducted by the Rev. J. Philip B. Pendleton, D. D., rector of the church, and the Rt. Rev. William Croswell Doane, Bishop of the Diocese of Albany, who read the service for the dead according to the rites of the Episcopal Church. After the service, the funeral cortege was escorted to the New York Central station, whence the remains were taken to Bristol, R. I., where the interment was made. The business houses of the city were closed during the funeral hours and the streets through which the procession passed were crowded with people.

CURRENT NEWS AND NOTES.

WIRELESS TELEGRAPHY ON CHANNEL STEAMERS.—It is stated that the Calais, Folkestone and Boulogne steamers will be fitted with Marconi poles, and at Dover ships' masts will be equipped for the purpose of establishing wireless communication.

WESTERN TELEPHONE RATES.—A special despatch from Cleveland, O., of Jan. 12 says: Representatives of the independent telephone interests of Ohio, Indiana, Michigan and part of Illinois, who have been in session here for several days arranging for long-distance business between the various local companies, have completed their work, with the exception of some minor details, and adjourned. It is probable that a general basis rate of half-a-cent a mile will be adopted for distances greater than forty miles, distances to be calculated in an air line. For less distance than forty miles there will be an arbitrary scale of rates with a minimum rate of ten cents and a maximum rate of twenty cents.

THE LATE S. DANA GREENE.—In a letter received from an eminent electrical authority, a reference to the death of the late S. Dana Greene is closed with the following words: "He was a sailor and a gentleman, besides being an engineer; a man who did not know fear, and absolutely gentle."

MUNICIPAL PLANT IN BIRMINGHAM.—A London despatch says that at a cost of $2,100,000, Birmingham has bought from a private corporation the city's supply of electricity. In 1886 the city sold it; but now, believing that even at much advanced figures it will yield a substantial profit, it has bought it back.

ELECTROLYTIC SODIUM.—A plant has been started at Farnworth, near Liverpool, England, to apply the Hargreaves-Bird process for separating sodium by the direct decomposition of salt by electrolysis. The cell in which the electrolysis is effected consists of a narrow tank with porous diaphragms. Brine direct from its native beds is pumped into the cells, and on the passage of the electric current, a solution of soda flows slowly down from the outside of the walls of the diaphragm, yielding at once soda crystals. The chlorine in like manner passes away for the production of bleaching powder, chlorate of potash and such other chlorine compounds as may be required. The diaphragm consists of a sheet of asbestos composition which is nonporous in the ordinary sense of the term, but when forming the walls of the cell, allows molecules of sodium hydroxide to pass and but very little sodium chloride. One of the claims for the process is that it permits the use direct of brine.

AUTOMOBILISM IN FRANCE.—The automobile clubs in the provinces of France are displaying great enterprise. The Automibile Velo Club of Nice has arranged an elaborate week's meeting for the Riviera, and now the Automobile Velo Club of Bearn has arranged a similar event, for Pau. This week will open with a tourist race from Pau to Peyrehorade and back, a distance of 140 kilometers, on Feb. 22. The next day the automobilists will be invited to the meet of the Pau fox hunt, which they may follow in automobiles. On Feb. 24 there will be an exhibition of automobiles in the Palais d'Hiver. On Feb. 25 there will be a speed contest over a distance of 325 kilometers, There will be two categories in the contest, carriages and motocycles. The first prize for carriages is 3000 francs, the second prize 2000 francs, the third prize 1000 francs, and the fourth prize 500 francs; the fifth in the contest saves the entry of 100 francs. The first prize for motocycles is 800 francs.

AUTOMOBILE PATENTS.—A compilation has been made by Mr. James T. Allen, Examiner of the United States Patent Office, of all patents on carriages propelled by electricity, gas, steam, spring or other power, granted by the United States from 1789 to July 1, 1899. The volume will contain photographic reproductions of all the drawings of the patents, together with a description of the nature of the invention, the essentials of the specifications, the claims in full and a complete index; also, a list of all references cited when the patents were pending as applications and of interferences, parties to them, and decisions. The compliation will also include complete illustrations of all patents regulated and classified under traction engines, portable engines, traction wheels, electric locomotives and other classes of an analogous character, but not strictly pertaining to the automobile industry. The volume will contain a digest of about 500 patents, and will be published by H. B. Russell & Co., Washington, D. C.

HENRY GUY CARLETON, the playwright, has come into the electrical fold, and is having a lively experience according to the following letter written to a well-known firm in this city, whose name, for obvious reasons, we suppress: "I have the honor to report that the four-cell alleged storage battery vended by you to us is not worth a something which cannot be expressed in a dictated letter, because my secretary belongs to the church. In the first place, the dodgasted old thing leaks electricity at every pore, and sweats current faster than a dynamo can pump it in. I filled up the slambanged thing day before yesterday for four hours, and with only ten minutes' work on my Ruhmkorff it has acquired a tired feeling, paralysis of the amperes and rheumatism in two of the volts. Really, the flabberjibbled whoof of a jabtit who put the thing together must have got some of the ends mixed up, or put in too little vinegar, or too much pepper, or not enough oil, and I would like to have your eagle eye look into it."

ELECTRIC AUTOMOBILE.—A patent was issued Jan. 9 to Mr. Elmer A. Sperry on the arrangement of the various parts and compartments of an electric automobile and on various devices and accessories connected therewith and designed to render such a vehicle complete in all of its details. The seat is so arranged that by tipping it forward the upper cells of the storage battery contained in a compartment in the body, are at once brought to view; by opening a panel in the body, the rear half of more of the cells are exposed, and by sliding an upper tier of cells backward, those contained in a lower compartment are readily brought to view for inspection. The dashboard is made hollow to accommodate the various devices connected with an electric automobile. Other claims of the patent relate to a system of control or management of the electrical circuits, a method of supporting the batteries, the ventilation of the battery compartments, the arrangement of current-controlling switches and steering gear, and on other details.

DETROIT MUNICIPALISM.—Mayor Maybury's message to the Detroit, Mich., common council opens with the public franchise question. It is one of the most vital of the day, he says. Shall the city assume the duty of owning and operating them and turn into the pockets of the many that which now goes into the pockets of the private owner? He thinks it should. He quotes the Berlin companies which, after earning a reasonable profit on the capital invested, are compelled to divide with the city. He admits that there is danger of corruption, but believes safeguards can be applied. With fitness and honesty as prerequisites to employment and inefficiency or neglect the only causes for removal he would consider municipal ownership as a certain source of benefit. His preference as to municipal ownership of street railways is that they should be owned by the city and be operated by the common council. Discussing present conditions the mayor says the rate charged is unreasonable and must lead to municipal ownership as soon as the first franchise expires. No new franchises should be granted in any event without submission to the people, the same as to the ownership of any public utility. It is also to be remembered, he says, that automobiles are coming into common use. As a remedy for overcrowding, he suggests a fare of 1 cent for a standing passenger. This would bring the company to time, he thinks.

TELEPHONE PATENTS.—Among the patents of Jan. 9 are three relating to telephony, one of which was issued to Randall S. Smith, another to Samuel B. Fowler and the third to John R. Blinck and Charles H. West. The Smith patent relates to a compact telephone outfit to be used in connection with an intercommunicating system. The transmitter and receiver are mounted on a jointed frame for the hand, the hinge of which contains a switch for breaking the battery circuit when the frame is closed ready to be suspended from the telephone hook. The hook forms part of the arm used to switch one or the other of the intercommunicating stations into circuit. The Fowler patent relates particularly to that system of telephony in which the source of the primary current is centralized at the exchange and in which the usual induction coil may be either located at the cord circuit at the exchange or in each station or instrument. The secondary of the induction coil is bridged across the line and the primary is in series on the line. Thus, the induced current is divided at the connection of the secondary with the line, one portion flowing in one direction and the other portion in the other direction. The Blinck-West patent has reference to the party-line telephone system, and is illustrated as being applied to six stations. The line consists of two conductors, and at each station there is a ground circuit normally connected to both sides of the line. The central station is provided with a signaling means for sending out particular currents or current combinations for operating selective electromagnetic devices at the substations, a single device being alone responsive to a particular signal. Means are provided at each substation for operating the locking apparatus of the other stations of the line, and means at the central station for unlocking the line; also means at each substation for blocking its apparatus when a call has been sent, so that the unlocking apparatus at the central station is inoperative with respect to that substation. In connection with the calling generator at each substation there are means for automatically connecting the generators with both sides of the line, and for also opening the circuit of the locking relay at the substation where the calling generator is operated. By the means described central can call up and connect any individual subscriber to the calling subscriber, the other instrument in the meantime being "locked."

ELECTRICAL PATENTS.—To those who desire to follow the development of the electrical art as exemplified by the current issues of patents relating to the same, a periodical now entering upon its second volume and entitled *Electrical Patents* will be found of much interest. In its pages all of the drawings accompanying a patent are reproduced to quarter scale, and all the claims are given in full. In addition a brief is included of each patent, pointing out its object and giving a concise description of the device patented. Trademarks and designs are also included, as well as all automobile patents. The publishers are H. B. Russell & Co., Washington, D. C.

INDUCTOR CONSTRUCTION.—A patent was issued Jan. 9 to Henry Geisenhoner, on the construction of the revolving inductor of inductor dynamos. Such dynamos when driven at very high speeds give forth a disagreeable sound, and the object of the present invention is to prevent this by building out the inductor to a substantially cylindrical form with materials to some extent nonresonant in character. The iron part of the inductor is of the usual laminated construction and the cut-away portion is filled with laminations of brass and some nonresonant material, such as compressed fibre. The filling is dovetailed into the structure, so as to render it capable of enduring the strains of the highest speeds used in these machines.

AUTOMOBILE STORAGE BATTERY INDICATORS.—Two patents were granted Jan. 9 on devices for indicating the condition of automobile storage bateeries—one to H. P. Maxim and the other to H. F. Cuntz. The object of both inventions to is warn the operator of the approach of the batteries toward the danger point of exhaustion. The devices employed are dependent for their operation on a decrease in the voltage below the predetermined minimum, and only under otherwise normal conditions; that is, should the voltage be reduced below the danger point for a short time only, as when a heavy load is temporarily put upon the batteries, in the case of an automobile mounting a steep grade, the danger signal becomes ineffective or inoperative. In the Maxim patent an indicator having a visual signal comprises a voltmeter and ammeter combined in such a way that should the rate of discharge be abnormal, the voltmeter scale will not be visible; under normal conditions, however, the voltmeter scale is visible, and then the operator will be informed by a glance at the voltmeter needle as to the condition of the battery. By means of a similar combination an audible signal is operated. In this case if the voltage falls below the danger point, when other conditions are normal an alarm is sounded; but if during the drop of the voltage below the danger period the amperes rise, an ampere switch will be opened at the time when the volt switch is closed and the alarm circuit will not be complete. The Cuntz patent relates to a device of the same class, which consists in the combination of a voltmeter and electromagnetic device, which latter is wound to respond to differences in current, and is connected to operate a switch controlling the voltemter.

THE FREEMAN TRANSFORMER PATENT CASE.—Judgment of priority of invention was rendered in favor of W. K. Freeman on November 27 last by the Patent Office examiners in four transformer interference cases, as follows: 1. Freeman vs. Bernstein, vs. Hunter, vs. Thomson & Houston, vs. Westinghouse Company & Gibbs; 2. Freeman vs. Hunter, vs. Halleck, vs. Brush, vs. Thomson; 3. Freeman vs. Hunter, vs. Thomson; 4. Freeman vs. Thomson & Houston, vs. Westinghouse Company & Gibbs. The issues in the above four interferences were respectively as follows: 1. The use in a system of electrical distribution of a transformer in which the primary coil within the influence of the magnetic field exceeds the length within the same field of the secondary coil. 2. The use in a system of electrical distribution of two or more independently arranged transformers having their primary coils in multiple on the main conductors. 3. The use of transformers in multiple to step down voltage. 4. The use of primary alternating currents for producing, by means of transformers, secondary alternating currents of greater quantity and less e. m. f. Freeman claimed that his first conception of the invention involved in the interferences was in August, 1877. The decision records Freeman's conception of the invention as 1880 and reduction to practice with diligence in 1884; Hunter's conception of the invention and reduction to practice in 1884; Thomson and Houston's conception in 1885 and reduction to practice in 1886; Westinghouse Electric Company & Gibbs' conception of the invention in 1885 and reduction to practice in 1885 or 1886; Thomson's conception of the invention in 1879 and reduction to practice in 1885; Brush's conception in 1879 and reduction to practice in 1887. In the early stages of the case Edison, Zipernowski, Déri and D'Arnefeil were interested, but their cases were dismissed in the preliminary examination.

LETTERS TO THE EDITORS.

In Memoriam—S. D. Greene.

To the Editors of Electrical World and Engineer:

Sirs:—May I trespass on your space far enough to say what occurs to me about the late S. Dana Greene? His place in the class of naval cadets at Annapolis to which he belonged was so high that he might with confidence have looked forward to the highest preferment in a service to which he was devoted, yet he manfully gave up his chance of being an admiral because he could not see his way to remaining in the navy without encroaching upon his mother's slender income. In after life, when he had become a successful business man, he always cherished the earliest object of his awakened ambition, though he never openly expressed regret that he had followed what seemed to him to be the path of duty.

In his business career he climbed the ladder of promotion by self-denying, diligent and honorable service, respecting himself, respecting his employers, and respecting the work which fell to his hands to do. In his intercourse with his official superiors, equals and subordinates, as well as with his customers and the outside world, he was tactful but truthful; reserved but sincere; often cordial but never familiar; prompt, energetic and accurate in discharging his multitudinous duties.

To find his attitude on any given question which might arise one had only to determine what would be the view of a tolerant, impartial and honorable spectator—his zealousness for his company's advancement never betrayed him into sharp practice, he gained universal esteem by his uprightness and held it by his serenity.

To this man at the early age of thirty-five had come a splendid position in the business world, official recognition of his energy and ability as a volunteer defender of the state and nation, ample means and a charming home in which was enshrined a woman in every way worthy of him. To-day they seem "but as yesterday when it has passed, and as a watch in the night."

Yet their lives, and more conspicuously his, are full of encouragement and fruits. In these days when men so often consent to lower their standard of business integrity for the sake of gain, it is well to bear in mind that S. Dana Greene left his chosen vocation in life at the call of duty and achieved success and some measure of fame in necessity's field with ideals intact and with untarnished honor.

NEW YORK CITY. IGNOTUS.

Paralleling Compound Wound Dynamos.

To the Editors of Electrical World and Engineer:

Sirs:—In your editorial comments upon my leter published in your issue of December 23d, you give in general a fair statement of the effect of coupling compound dynamos, but what you state is an argument in favor of adjusting the potential of the incoming machine before energizing its series field.

You say I take the stand "that the throwing of an unloaded compound-wound machine in parallel with another, does not alter the voltage of the latter." You add "this is, of course, true for machines compounded for constant potential, but it is not true for machines which are overcompounded." I said that the coupling of the new machine with another would not alter the voltage at the bus bars, and this is true whether the machines are evenly or overcompounded.

Your description in the second paragraph of the behavior of two overcompounded machines prove this.

You say the voltage of the fresh machine will rise to about 575 volts and the voltage of the other machine will fall to about 525. I assume that by "voltage" you mean e. m. f., for it is absurd to say that two machines connected to the same bus bars could have a difference of voltage of 50 volts. The e. m. f. of the fresh machine does rise, and that of the other falls, but the fresh machine takes so much more than its own share of the load that the voltage at the bus bars remains unchanged.

This unequal division of the load is, of course, objectionable, but in what I have said I have had reference to incandescent lighting systems, and on such systems it is far more objectionable to disturb the voltage of the system, than to have a fresh machine take for a moment more than its share of the load. The adjustment of the load between the machines is easily and quickly accomplished after they are thrown together. As you state near the end of the same paragraph, the attendant may, if he is sufficiently expert, check the building up and prevent the fresh machine from taking more than its share.

Of course it is feasible to manipulate machines as you describe in the last paragraph, without producing any disturbance in the system, but the attendant must be an expert to prevent any change of voltage at the bus bars when half the current is suddenly diverted from the series field, and this is true whether the machines are overcompounded or not.

I wish to reiterate what I stated in my last letter, that machines to be used parallel should never be overcompounded. The object of overcompounding is to make up for losses in the system, and if several machines are used in parallel, the overcompounding can only be correct when all the machines are in use. If a system employs five machines overcompounded 10 per cent., that overcompounding would be five times too great when one machine only was running. To prevent such an abnormal voltage when part only of the machines were in use it would be necessary that all the series field should be in circuit all the time, whether the machines were running or not.

WM. A. ANTHONY.

NEW YORK, N. Y.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Alternators in Parallel or in Series.—LEBLANC.—A theoretical article in which he develops the reasons which disturb the synchronism of alternators which are working in parallel; he concludes that the only efficient remedy is his "amortisseur," and cites the plant of the Oberspree Co., in Berlin, where two large alternators of 1000-hp refused to work in parallel until they were provided with amortisseurs. All converters of the General Electric Co., of Berlin, are said to be provided with this device. He points out the difficulties in bringing two alternators into synchronism and the great dangers of accidents during that time, and claims that it would be desirable to have alternators which could work in parallel without synchronism and which could be connected to a network gradually like continuous current machines. The induction motor, if used as generator, is such a machine, as it has no definite frequency of its own, but can operate at any frequency above that corresponding to its speed. He quotes his experiments in Saint Ouen with two alternators supplied with amortisseurs, in which one of them could be changed instantaneously into a non-synchronous machine by stopping the excitation of the field; no trouble was experienced, but the alternator, thus transformed into a non-synchronous machine, began to revolve a little faster; then in the other machine the steam was throttled so that the working system was that of a non-synchronous generator feeding a synchronous motor, the generator furnishing to the motor the watt currents necessary to produce rotation and the motor furnishing to the generator the wattless currents necessary for its excitation. He gives a brief outline of a station containing a number of non-synchronous generators, all identical and all supplied with the special exciter described in a former article (noticed in the Digest, Jan. 13) except one which is furnished with a special commutator. This machine is thus made a compound alternator of constant voltage. When it is working in connection with the others, it acts as the "frequency setter." Regulation is effected by means of the engines. Finally he points out that non-synchronous machines can be run as well in series as in parallel, if they are coupled to an alternator which compounds for constant current. The summary of his long series of articles is given as follows: Although the problems of alternating currents are more complex than those of continuous currents, the difficulties can be overcome. The resonance phenomenon, due to capacity, can be prevented, even in lines with armored cables, by a proper design of the armatures. The effects of self-induction can be overcome by a special method of excitation. The running of the alternators in parallel or in series is as simple as that of continuous current machines, as it is no longer necessary to use synchronous machines only; the use of alternating current systems is therefore as convenient as that of continuous current systems, while all its special advantages are retained.—*L'Eclairage Elec.*, Dec. 2.

REFERENCE.

Leblanc Amortisseur.—A short illustrated communication explaining the construction and action of this device, which was referred to in the Digest Dec. 16 under Electrical Progress, S. P. Thompson, and in the Digest Jan. 13 under Running Alternators in Parallel, Benischke.—Lond. *Elec. Eng.*, Dec. 29.

LIGHTS AND LIGHTING.

Nernst Light.—An article on the first exhibition of the Nernst lamp in Paris. The ratio of the powers consumed by a Nernst lamp and an incandescent lamp at the same candle-power is said to be 2 to 5. The life of the Nernst lamp is given as 300 to 400 hours; at the end of this time only the filament is to be replaced. The Nernst lamp can be constructed for high voltages without any difficulty. The rest of the information given in the article is rather vague.—*L'Elec.*, Dec. 30.

In an article on the same subject, it is stated that the Nernst lamp will not be introduced commercially before the end of the Paris exposition; a large number of these lamps will be installed by the Geneneral Electric Co., of Berlin, at this exhibition.—*L'Eclairage Elec.*, Dec. 16.

Cost of Arc Lights.—LEDERLE.—An article on the cost of operation of the public lighting of Atlanta, Ga., where by a provision of the existing contract the city authorities may claim at certain intervals a reduction on the cost of lighting, provided they can prove that the profit of the local light company is excessive. Recently this question was submitted for arbitration to a special committee, which was allowed to examine the books of the company. The results of their examination are given in some statistical tables; it was found that the cost of operation with 6 per cent. interest on the capital invested and a depreciation of 7½ per cent. for a 2000-cp lamp during the year 1898 was $84.39, while the city paid only $81.24.—*Dixie* (Atlanta, Ga.), December.

POWER.

Electrically Controlled Elevator Gear.—A well illustrated description of one of novel design; two of this type were recently erected in an English warehouse and are in successful operation under very severe conditions. The motor is ironclad and the weight of the empty lift is balanced by counterweight to the usual extent. If the load in ascending or descending is such that it drives the motor above its proper speed, the motor itself acts as a break by generating current and returning it to the supply mains. Should the supply mains at any time be incapable of absorbing power, provision is made to prevent over-running by supplying a powerful friction brake through the action of a solenoid, the circuit of which is closed and opened by a centrifugal governor driven from the motor shaft. This brake consists of two arms held clear of the brake drum by means of an electromagnet against the pull of a strong spiral spring. The coil of the magnet is in shunt across the mains, the circuit being made and broken by the starting switch. The motor is connected by a claw coupling having 90° play to two right hand and left hand worm gears which take up the thrust, thus preventing loss of power by friction. Upon the axle of each worm is mounted a pulley, round which the cable runs. The worm gear is completely enclosed in an oil bath, and runs for a considerable time without attention. An endless rope

running through the cage actuates the starting and reversing switch. The motor is started through a resistance, the cutting out of which is performed automatically. By closing the starting switch by means of a hand rope from the cage, the brake is held off and the motor starts slowly, increasing the speed gradually as it cuts out the resistance in circuit with the armature until full speed is obtained. It is claimed that failure on any part of the apparatus is unattended by danger, that nothing depends on the skill of the operator, and that a very high efficiency is attained.—Lond. *Elec.*, Dec. 22; *Lightning*, Dec. 28.

Power Losses in the Machine Shops.—BENJAMIN.—An article with several diagrams and tables showing the enormous power losses in machine shops. The losses due to belts and pulleys are prevented by the use of individual electric motors, the power losses are, however, large enough even in electric transmission. The principal arguments for electric power in machine shops do not concern the saving of power, and are summarized as follows: Better arrangement of machinery to facilitate handling of work; clear head room for the use of electric cranes and small hoists; light and cleanliness; general flexibility of the system for changes and extensions; the use of electricity for other purposes than power.—*Cassier's Mag.*, January.

Refuse Destructor.—Some notes supplementary to the paper of Russell, noticed in the Digest Jan. 6, together with an abstract of the discussion which followed this paper. The advantage of the combination of refuse destructors and electric lighting plants is questioned. It is said that a well-constructed destructor and a well-designed electrical installation would work better if each were independent of the other. In the combined plant at Shoreditch, there was a large expenditure on the capital account and a very considerable expense upon the current account, therefore the outlays were not justified by results. It is pointed out that this apparatus while suitable for a district such as Shoreditch with its crowded population, would be in nowise suitable for a large majority of towns whose sanitary requirements are as great as Shoreditch, but whose means of meeting the same are far more limited.—Lond. *Elec. Rev.*, Dec. 29.

REFERENCES.

Power for Cotton Machinery.—WEBBER.—A short article giving figures for the power required for operating cotton machinery. The figures were obtained by measurement, but how, is not stated.—*Power*, January.

Electric Pumps.—An illustrated description of the pumping station in Austin, Texas, where a four-million gallons duplex pump and a six-million gallons triplex pump are installed, driven by synchronous electric motors. They are started alone and are then coupled to the pumps by friction clutches.—*Sc. Amer.*, Jan. 13.

Roller Bridge.—An illustrated description of the roller bridge installed in the steam boiler plant of Piedbeuf in Liege. It is operated by three electric motors of 15, 10 and 5-hp.—*L'Eclairage Elec.*, Dec. 9.

Utilization of Blast Furnace Gases.—A short article giving some historical notes.—Lond. *Elec. Rev.*, Dec. 20.

TRACTION.

Power Station in New York.—A very long illustrated description of the new station of the Third Avenue Railway Co., which is now being built, and which is said to be the largest in the world, having an output of 100,000-hp. Three-phase currents at 6600 volts will be transmitted to the substations where they will be transformed down to 500 volts direct current. The description is limited to the steam generating machinery; another article in the same issue gives a long illustrated description of the underground conduit system of that line, which is now completed. This company owns about half the mileage in New York City and has about 29 miles of track now in operation using the underground conduit system; the conduit, cars, etc., are described in detail; air brakes are used. At present a temporary power station is used.—*St. R'y Jour.*, Jan. 6.

Chinese Tramway.—A short note stating that the first Chinese electric tramway, about 4 miles long, has been opened, connecting the Pekin railway station at Machiapu with the South Gate of the capital. Its installation is important as breaking through the official superstition which located the steam railway terminal 4 miles outside of the walls of Pekin.—*Eng. News*, Jan. 4.

Surmounting Grades.—An inquiry asking whether it is possible to run 44 ft. double truck cars, each having four motors of 50-hp, over a 4 per cent. grade. It is answered in the affirmative by the editors, who state that 6, 8 and even 10 per cent. grades can be mounted by such cars with sufficient motive power.—*St. R'y Jour.*, Jan. 6.

Automobile Accumulators.—BAINVILLE.—A continuation of his series of articles on the prize competition for automobile accumulators under the direction of the Automobile Club of France (Digest, Dec. 30). The results of the month of October are given in two tables. The failure of those batteries which had been satisfactory so far, is reported. At the end of October all batteries which started at the beginning of the test, have been either entirely eliminated or have been taken out of the circuit a number of times. The only battery which has not failed so far, was started after the 18th discharge. The conclusion is drawn that the average life of the present accumulators is not more than six months, after which time rather expensive repairs are necessary. This conclusion is drawn from the tests of accumulators of robust construction, of a capacity which is high relatively to the required rate of discharge, and of a considerable weight. Perhaps it would have been possible to have prolonged the life of some of them by a more careful construction, but this is questioned. Others might stand the tests with the utmost care in the handling, but this cannot be given to batteries in commercial use.—*L'Elec.*, Dec. 16.

REFERENCES.

Automobiles.—An abstract of a report made by Cuenot and Mesnager to the French Society for Advancement of Science. After a historical introduction on automobilism they discuss the resistances to be overcome, the motors actually in use, the connection of the motors with the wheels, the steering, the relative weight of the different parts, and the price of automobiles. Also an abstract of a communication of Pasqueau on the transportation of automobiles by railways and of a communication of Bricka on the use of automobiles in the colonies.—*L'Eclairage Elec.*, Dec. 16.

Single Rail Tramway.—A reprint, with illustrations, of the English article noticed in the Digest Jan. 13.—*El'ty*, Jan. 10.

Conduit System.—REYVAL.—A very long, well illustrated description of the new tramway line from the Porte d' Asmieres to the Bastile in Paris, where the conduit system with lateral conduit is used.—*L'Eclairage Elec.*, Dec. 9.

Traffic Between New York and Brooklyn.—An illustrated article pointing out the insufficiency of the facilities of the present Brooklyn Bridge. There is no remedy for this except the building of more bridges or tunnels.—*St. R'y Jour.*, Jan. 6.

Energy of a Pound of Coal for Railway Service.—HERRICK.—A short article accompanied by a colored chart, showing the losses from the coal pile to the car axle in electric railway service. The chart is based on the best average conditions for 16 stations and over 300 car equipment tests. He also considers various plans for reducing the losses.—*St. R'y Jour.*, Jan. 6.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Combined Lighting and Traction Plants.—ADAMS.—A short article of general nature pointing out that the union of public electric light and power plants with traction plants is the next inevitable step in the march of power centralization and that the advantages which lie in the use of the same dynamos for both purposes will cause to raise generally the voltage of incandescent lamps up to 250.—*Cassier's Mag.*, January.

REFERENCES.

Bonn.—BAUER.—A long abstract of the article noticed in the Digest Jan. 6. The installation is also commented upon in an editorial note.—Lond. *Elec.*, Dec. 29.

Lighting Plant.—WAKEMAN.—A long article of general nature on the installation and operation of an electric lighting plant. He describes how to select the types of the machines and the size of the wires; also methods of putting up wires, cut outs, feeders, switches and lamps, and gives some general suggestions.—*The Eng.*, Jan. 1.

WIRES, WIRING AND CONDUITS.

Cable Breakdowns.—KAPP.—A long theoretical article. It has been found that in switching in or out single parts of the network formed of concentric cables, there was danger of a discharge from the outer conductor to the lead armor, and that this danger can be overcome by following the rule of Neufeld, which is, that, in switching in, connect the outer conductor first, and in switching out, disconnect the inner conductor first. The reasons of this phenomenon, as given by Siemens, Fleming and Feldmann, are described analytically with the aid of diagrams. He then discusses another case which had not yet been explained, namely, that of cable breakdowns caused by earth contact of the inner conductor. Such breakdowns are gen-

erally quite serious, as they are usually accompanied by failures at several points; they have been observed only in complex networks of concentric cables, and have not occurred in installations with single transformers. He gives the theory of these accidents analytically and graphically and finds that the network can be protected successfully against such breakdowns only by earthing the outer conductor. This can be done only at one point, on account of the telephone disturbances which would otherwise occur; but this is sufficient, if no fuses are used in the outer conductor. It is feasible to insert an inductionless resistance into the earth connection, so that in the case of an earth contact of the inner conductor the current does not become greater than is necessary to melt the inner conductor fuse. In twisted cables there is no outer conductor and therefore this protection is impossible; fortunately, however, twisted cables have much less capacity than the concentric, and the danger is therefore much less. As these dangers result from too large, and never from too small charging currents, the voltage should not be unnecessarily high. A very small iron and copper loss in the transformer increases the danger, but in a much smaller degree than too great a current at no load and a large inductive voltage drop. Therefore the first consideration is a most favorable construction of the transformers in this respect. With twisted cables each end of a conductor is to be supplied with fuses, but at the central station end stronger fuses should be used than at the remote end; in complex networks too small transformers should not be installed. With concentric cables the outer conductor is not to be fused in complex networks; it is to be connected to earth through a resistance.—*Elek. Zeit.*, Dec. 28.

India Rubber.—TERRY.—An article in which he points out that the two principal objections which have militated in the past against the use of vulcanized rubber in place of gutta percha for deep sea cables are the porosity of rubber under pressure—or indeed at atmospheric pressure alone—and the fact that the coating of rubber has hitherto been put on the cable in a jointed condition and not in the seamless state like gutta percha. While it is extremely doubtful if the porosity in rubber can be overcome except by some drastic change in the methods of manufacture, seamless india rubber cables are now made. He then discusses how far the new substitutes for india rubber can compare with the latter as to these effects, and thinks that they will be found less porous than rubber, and that certainly in some cases there will be no difficulty in putting on the insulated mixture in the seamless condition. Other and weighty questions are the insulating capacity and probable life. The inimical action of atmospheric oxygen and sunlight upon india rubber are not felt in deep sea cables. While for certain purposes connected with electric lighting, excellent insulation has been obtained by the use of poor quality rubber, he thinks that the discredit that has come upon rubber insulation by the failure in some of the large towns of England, is to some extent attributable to the use of low class insulation from motives of economy. First-class rubber cables last a long time; he refers to St. Petersburg, where cables laid fourteen years ago are still giving satisfaction. He has not yet seen a substitute which compared at all to good india rubber as to tensile strength, which, however, is not a prominent requisite in the case of insulating rubber. Such substitutes, being already oxidized bodies, cannot, like india rubber, undergo the chemical changes to which hydrocarbons are subject. As gutta percha contains so much resinous matter, it is less porous to water than india rubber; the substitutes, being more nearly allied to resins than to hydrocarbons, may prove in this respect of equal, if not superior value, to gutta percha and *a fortiori* to india rubber. Chemical analysis of substitutes does not afford all the information wanted, and it is necessary that such analysis be supplemented by practical tests. The article is commented upon in an editorial note which points out that there are many applications in which either rubber substitutes or seamless rubber insulation may be tried experimentally before they are used to insulate deep sea cables.—Lond. *Elec.*, Dec. 29.

ELECTRO-PHYSICS AND MAGNETISM.

Becquerel Rays in a Magnetic Field.—BECQUEREL.—A description of some experiments; in one of which a small piece of radio-active barium, wrapped in aluminum foil, was placed in the centre of an iron disc forming one pole-piece of a strong electromagnet, while the other pole-piece carried a fluorescent screen. When the magnet was not excited, a faint and widely dispersed luminosity was found on the screen. As soon as the magnet was excited, the luminous area contracted and became more intense, the result being unaffected by a reversal of the poles. Sensitive plates showed the increase of intensity very clearly, a strongly marked negative being obtained in a minute and a half with a distance of 0.6-inch between the pole-pieces. When the rays pass across the lines of magnetic force, and not along them, they behave in a very different manner. When he placed a small piece of radio-active barium midway between the two poles of a magnet, and a fluorescent or photographic plate between the two poles, an impression was produced just under the radiant substance, but not round it; another impression extends in a curved line from pole to pole, curving out of the way of the substance in the middle, the convexity being towards the right in looking along the lines of force.—*Comptes Rendus*, Dec. 11; abstracted in Lond. *Elec.*, Dec. 29.

GIESEL.—A description of similar experiments showing the deflection of Becquerel rays in a magnetic field.—*Wied. Ann.*, No. 12; abstracted in Lond. *Elec.*, Dec. 29.

Quantity Discharges.—TROWBRIDGE.—A short illustrated article on discharges of 150 plate glass condensers 18 x 20 inches arranged in multiple, and charged to 20,000 volts by storage batteries. Very high instantaneous states of temperature can thus be obtained. One view shows the deflagration of a No. 30 iron wire 6 inches long, and another when the wire was in shunt to the spark gap; the latter showed that for large quantity discharges, a discharge might occur inside of a metallic cage, as the cage may be considered to be the shunt to a minute spark gap inside; as there is large quantity in lightning discharges, he concludes that a metallic cage does not seem to be a complete protection in all cases for a powder magazine. With these quantity discharges it is possible to obtain photographs of the spectra of gases by one discharge.—*Elec. Rev.*, Jan. 3.

Conductivity of Gases Exposed to Discharge Rays.—J. J. THOMSON.—An account of a series of experiments showing that the discharge rays which emanate from a region through which an electric discharge is passing, move in straight lines, are not deflected by a magnet, and are stopped by solids, liquids and some gases, such as carbon dioxide; they produce conductivity of the gases through which they pass, and the effect is greater in hydrogen and less in carbon dioxide than in air. The radiation is emitted more copiously from the neighborhood of the electrodes than from the rest of the spark; it appears therefore to be connected with the ionization of the gas and its recombination.—*Cambridge Phil. Soc. Proc.*, June 7, 1899; abstracted in *Science Abstracts*, December.

Current Without Difference of Potential.—ROSENBERG.—A communication referring to the article of Teege, noticed in the Digest Jan. 6. He says that a case similar to that described by Teege is that of a short-circuited alternating current generator. The essential point in both cases is that the whole circuit consists of equivalent elements which not only generate but also consume energy, so that the law which states that the algebraic (or for alternating currents the geometric) sum of the acting e. m. fs. and of the e. m. fs. consumed by the resistance or impedance, is zero, holds good in these cases not only for the whole circuit, but also for each element of the circuit, if in the case of a short-circuited alternator a single turn or a half-turn is regarded as element.—*Elek. Zeit.*, Dec. 28.

Motion of a Charged Ion in a Magnetic Field.—J. J. THOMSON.—A paper treating of the motion of an electrically charged particle in a magnetic field, when the free path of the particle is so short that the effects of collisions form a dominant factor. If ions move with different speeds in a magnetic field of constant strength, those moving at high speeds travel along the lines of magnetic force, those moving at lower speeds along spirals. This accounts for the difference in behavior of the negative glow and of the positive column of a vacuum tube in a strong magnetic field; as in the discharge of electricity through gases, the velocity of the negative ion is greater than that of the postive, the negative glow follows the lines of magnetic force, while the positive column follows a more or less spiral path.—*Cambridge Phil. Soc. Proc.*, June 7, 1899; abstracted in *Science Abstracts*, December.

Theory of the Earth's Magnetism.—ROWLAND.—A daily paper gives a brief and somewhat vague account of a theory of Prof. H. A. Rowland, of Johns Hopkins University, and which, if correct, he thinks will be of some importance; at present he considers the theory is somewhat immature. It seems that his idea is that a body moving through the ether generates an electric current in itself, which current circulates through the body itself and causes the force known as magnetism. The earth moves through space at the rate of about 17 miles per second, which is sufficiently rapid to generate immense electrical currents; his theory is illustrated by an experiment.—Sunday *Herald*, Baltimore, Jan. 7.

REFERENCES.

Pressure and X-Ray Ionization.—HILLERS.—A long French abstract of the German paper noticed in the Digest Aug. 5; also of an abstract of the former investigation of Winkelmann which was continued by Hillers.—*L'Eclairage Elec.*, Dec. 2.

Potential Gradient at the Anode in Vacuum Tubes.—SKINNER.—An illustrated French abstract of the article noticed in the Digest Sept. 16.—*L'Eclairage Elec.*, Dec. 9.

Thermoelectricity.—VOIGT.—An unfavorable criticism of the theory of Liebenow (Digest, July 29).—*Wied. Ann.*, November; briefly abstracted in *L'Eclairage Elec.*, Dec. 2.

Minimum Charging Current of a Condenser.—RUSSELL.—A short illustrated article giving a solution of the problem to find the form of wave of potential difference which produces the smallest effective current in charging a condenser to a given potential in a given time. It is also the solution of the alternating-current problem of finding the form of the potential difference wave which makes the condenser current a minimum, the maximum height and the frequency being given. The solution shows that the required wave is triangular in shape.—Lond. *Elec.*, Dec. 29.

ELECTRO-CHEMISTRY AND BATTERIES.

Mineral Production and Chemical Industry in the U. S. in 1899.—Statistical articles comprising the entire issue. The high price of copper and the suitability of aluminum for conductors has caused copper to be supplanted to some extent in electrical power work; the consumption of aluminum for minor uses is also increasing; the output of 1899 was 6,500,000 pounds, as against 5,200,000 pounds in 1898. The high prices for copper have stimulated mining, but the total output of copper for the year from domestic ore was, after making allowance for that recovered in the by-product of copper sulphate, 592,672,637 pounds, showing a gain of only about 11 per cent. over the figures for 1898, 535,900,232 pounds; the normal increase of production is about 10 per cent. The production of the various zinc refineries and smelters in this country in 1899 was 135,796 short tons; the high price stimulated the output, the 1898 figure being 114,104 short tons; the export of zinc ore more than doubled, being 27,526 short tons in 1899 and 11,782 in 1898. The domestic production of soda, including soda ash, caustic soda, and other products, reduced to a common basis of 58 per cent. soda ash, in 1899 was 363,000 tons compared with 340,622 metric tons in 1898; the electrolytic process work showed, if anything, a decrease. The copper production of the United States is about 65 per cent. of the total copper output of the world; out total exports in 1899 were 115,050 long tons of fine copper, or a little over 20,000 tons less than in 1898. Special articles are devoted to the various metals and minerals, and to the production in different places. About chemical industries it is remarked that they are in a state of transition. The older processes are engaged in a struggle for life with the newer electrolytic methods of manufacture, and "the struggle is hardly a doubtful one," although it may last for a long time. On the other hand, the electrolytic processes are by no means perfected as yet. Special articles are devoted to alkalies and chlorine, and chemical markets, and very long statistical tables regarding the mining stock exchanges.—*Eng. and Min. Jour.*, Jan. 6.

Aluminum.—ROBERTSON.—After a brief introduction he describes the recent sulphide process of Gooch. There are two general classes of methods: those in which the solution is that of its oxide, and the other that of the sulphide. As the heat of combination of the sulphide is only one-third that of the oxide, it can be more easily reduced than the oxide. In existing processes aluminum sulphide is either formed externally to the bath and then added to it, or from alumina suspended in the bath. Gooch, however, forms it from the aluminum oxide which is dissolved or combined in the bath; three parts sodium fluoride to two parts aluminum chloride, are fused in an iron tank provided with sleeves for the insertion of the anodes, and lined on the bottom and half way up the sides with compact carbon; the remainder of the tank and the sleeves are lined with compact alumina, which serves to keep the anodes from electrical contact with the tank and casing; the anodes, which are perforated longitudinally, are formed of carbon, and connected by copper rods to a metal bar which rests on wooden supports; the carbon lining serves as the cathode. Carbon bisulphide is introduced into the bath through pipes forming tight joints with the anodes, so that the pipes are continuous with the perforations in the anodes. The gaseous products escape from the bath through a bell made of boiler iron plate and lined with compact carbon and suspended from the bar over the bath. When the carbon bisulphide is introduced, it acts on the dissolved alumina to convert that oxide into aluminum sulphide, while carbon oxysulphide or carbon monoxide is formed at the same time. Then an electric current of about 0.9-volt, but varying according to the constitution of the bath and the size of the electrodes, is passed through the bath. The aluminum deposited at the cathode is removed by ladle or siphon, while the sulphur liberated at the anode passes off through an outlet in the bell. By supplying alumina to the bath through the space between the rim of the bell and the interior surface of the tank, and maintaining the current of carbon bisulphide, the production of aluminum sulphide goes on continuously and, if properly regulated, keeps pace with the electrolysis.—Lond. *Elec.*, Dec. 22.

Electrodeposition of Copper.—COWPER-COLES.—An article on the conditions which favor the formation of copper trees and nodules. Swan found that regularity and smoothness of deposit was almost entirely dependent on the absence of solid particles held in suspension in the electrolyte and that at the seat of each nodule was a speck of some foreign substance. Gore observed that the greatest length of nodule is in the direction of the greatest intensity of current and amount of copper in solution. Cowper-Coles tried the effect of various current densities, strength of solution, acidity of solution and temperature; also cathodes of various shapes. An initial current density of 60 to 70 amp. per sq. foot was found the best for the growth of copper trees. He reproduces photographs of trees from various solutions. Other photographs show a copper tree from a revolving cathode and copper cones deposited at 10 and 32 revolutions of the cathode per minute.—Lond. *Elec.*, Dec. 22; reprinted in *El'ty*, Jan. 10.

Depolarization With a Chlorate.—A short article which appears to be an abstract of another, describing some unsuccessful and a successful battery by Platner. The description is not clear, but the battery seems to consist of a carbon cylinder containing in the inside a "chlorate mixture" and covered on the outside with a paste of the usual pyrosulite; presumably the other pole is zinc, but what the liquid is, does not seem to be stated. This combination is said to have all the advantages of the ordinary black oxide of manganese or pyrosulite cells like the Laclanché, but seems to depolarize better; the voltage is as high as 2 and the current is said to be much greater than in the best types of cells of this kind in use. It is thought that the high voltage is due to the development of chlorine; moreover, the hydrochloric acid formed from the chlorine tends to bring the materials into solution when they would otherwise be precipitated.—*Elec. Tech.*, Dec. 15.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Electric Units.—FLEMING.—The first part of an article. Referring to the article of Fessenden, in the ELEC. WORLD AND ENG., Dec. 9. he says that, taken in conjunction with Heaviside's rational units, it seems to pave the way for a revision of the system of electrical units which is at once practicable and sound. Heaviside's system starts with a new definition of the unit magnetic pole. The British Association Committee defined the unit magnetic pole as a pole which at a distance of one centimeter repels another like pole with a force of a dyne; this definition neglected the effect of the permeability of the medium and created the "4π-eruption." Heaviside applied a radical remedy for the second defect by defining the unit magnetic pole as one which repels another like pole at a distance of one centimeter with a force of 4π dynes. He evolved thus a series of electric and magnetic units, different from the British Association units in size, but characterized by the property that there are no unmeaning constants in the equations expressing their relations. In two tables it is shown that the Heaviside units are all incommensurable in size with the B. A. units, and in six cases out of ten involve a factor 10 or 1/10 as well. He points out that by adopting the dekampere, the deciohm and the decihenry as units, the decimal factors can be eliminated. He then gives in a table the c. g. s. dimensions of the electric and magnetic quantities in the electromagnetic system and considers also the permeability as a fundamental of unknown quantities (while usually the permeability is supposed to have the dimension of a pure number). He finds that the power under which 4π enters as the multiplying factor to convert Heaviside reckoning to B. A. reckoning, is in every case except that of magnetic force and magnetic pole strength, the same as the power under which the dimension of magnetic permeability makes its appearance in the dimensional expression. This fact supplies the clue to a modification of the suggestion made by Fessenden. Both in the B. A. and in the Heaviside

systems the magnetic permeability of ether or of air is taken as unity. "If we take the permeability of ether to be 4π units instead of unity, we rationalize at one stroke all our present units except the units of magnetic force and magnetic pole strength." $(4\pi)^2$, as stated in the original article, is supposed to be a misprint. The following units would therefore be a rational system: the permeability of ether is 4π units absolutely; the unit magnetic pole is $\frac{1}{4}\pi$ times the present c. g. s. pole, which would disturb no one, as no practical electrician ever requires to measure a pole strength in absolute measure; the unit of magnetic force is the dekampere-turn per centimeter, or 10 ampere-turns per centimeter, or 4π times the present c. g. s. unit; the unit of electric quantity is the present dekacoulomb; the unit of electric resistance is the present deciohm; the unit of inductance is the present decihenry; the unit of magnetic flux is the present c. g. s. unit or one line of force; the unit of e. m. f. is the present volt; the unit of m. m. f. is the present dekampere-turn, or 10 present ampere-turns; the unit of power is 10 times the present watts, and the unit of energy 10 times the present joules; the unit of capacity is 10 present farads and it too large for practical use, so that a fraction of it must, as at present, be used, say one ten-millionth.—Lond. *Elec.*, Dec. 29.

Measuring the Hysteresis Loss in Armature Cores.—BAILY.—The results of tests made to examine Mordey's method of measuring the hysteresis loss in armature cores which consists in determining the losses in the moving parts of the machine when excited and when not, the difference being assumed to be due to hysteresis and eddy currents; he also suggests some improvements; these losses are then separated by varying the speed, the hysteresis loss being assumed to be proportional to the speed and the eddy currents to the square of the speed; these two proportionalities are said by the author to be correct; the chief source of error lies in the assumption that the mechanical losses are unchanged by the addition of the magnetic field, which is true only when the mechanical conditions are preserved entirely unchanged. The question of the change of load on the bearings due to the magnetization is discussed briefly. In Mordey's method the armature was driven by a belt passing through a dynamometer; the stopping of the field current changes the pressure due to the belt, and to avoid this, he makes the following improvement on the Mordey method: A small brake is applied to a pulley on the dynamo when the field is not magnetized, and it is adjusted so that the power absorbed by it is equal to that absorbed by the eddy currents and hysteresis; the brake is adjusted so that the reading of the dynamometer remains the same before and after the field is excited; the absolute measurement of the power is therefore measured by the brake, and the belt tension remains constant. The results of tests are given in a diagram and table. He refers to some points raised in the article of Scott (Digest, Jan. 8), and says that he found that the change produced in the hysteresis drag on an armature core by such excessive vibration as almost to endanger the spindle, was but slight, about 5 or 10 per cent., and any ordinary vibration due to mechanical causes did not produce any important effect; he adds, however, that it is not impossible that, in the case, say, of the inductors in an inductor alternator, in which the vibration is frequently severe, there may be some effect. The question of hysteresis in a slotted armature is said to be more complex; a multiple-wound electromagnet with 12 coils and rotating brushes produced a somewhat jerky or variable rotating field and produced in the iron core a value for the hysteresis approximating to that given by an alternating field. He thinks it therefore quite possible that, where there is any interference with the uniformity of the field, the hysteresis will approximate more nearly to the lower value. The case of a shallow ring armature is not quite similar to that of a nearly solid drum armature. The inner portion of the ring when under the centre of the pole-piece is in a very weak field, and the change that takes place there must be more akin to the cycle obtained in an alternating field.—Lond. *Elec.*, Dec. 29.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Energy of Telephone Currents.—CALDWELL.—An illustrated article calling attention to the fact that the so-called telephonic properties of a long line could be very much improved by connecting high-resistance leaks across it at frequent intervals, but this would require more powerful transmitters than it was possible to construct so far. He gives an account of experiments made by Blake and himself to determine under what conditions of battery induction coil, and adjustment of contacts, a transmitter would give the best results, and to measure the energy represented by the strongest telephone currents which could be reproduced. The strongest produced with a carbon transmitter was 5½ amp., and the maximum output was 2.25 watts. Under conditions of everyday practice the maximum instantaneous power is about one-quarter watt.—*Elec. Rev.*, Jan. 3.

REFERENCE.

Railway Telephone.—PIERARD.—A well illustrated description of the Dardeau system, used on the line from Saint Avertin to Tours in France. As many as 25 subscribers can be placed on the same circuit.—*L'Elec.*, Dec. 23, 30.

MISCELLANEOUS.

Preventing Collisions at Sea.—An illustrated description of what is called a pilot torpedo, which is a boat devised by Obecchioni to prevent collisions at sea; a high award was given for it at the last year's natutical congress in Rochelle. It is designed like an ordinary torpedo boat, is driven electrically by a 10-hp motor, and runs before the steamer which is to be protected, at a distance of 900 to 1600 feet, being connected with the steamer by two ropes containing insulated wires. As soon as the boat reaches an obstacle a bell is rung automatically on the steamer, and at the same time the boat recedes. When the obstruction is removed the boat goes forward again. The details of the torpedo boat are described.—*Zeit. fuer Elek.*, Dec. 24.

Consulting Engineer.—RICHARDSON.—A discussion of the duties and requirements. It is claimed that he should have a thorough technical and business training and be entirely free from all interests in manufacturing and contracting companies.—*St. R'y Jour.*, Jan. 6.

REFERENCES.

Progress of Electrical Industries in 1899.—A review of the past year including a table of the values of the electrical articles made in this country and imported, in each of the past two years; also a list of prominent American electrical men who died during the year, and the following short articles referring to the progress during the past year: Central Stations, by Niesz; Automobiles, by Githens; Storage Battery, by Clark; Isolated Lighting, by Pierce; Railway, by Chapman; Independent Telephone, by Critchfield; Electrochemistry, by Harding; Electrical Construction and Inspection, by Merrill. It is followed by the reports of a large number of manufacturers.—*West. Elec.*, Jan. 6.

A brief history of the year's progress by Child. An article on the foreign electrical progress in 1899.—*Elec. Rev.*, Jan. 3.

Smithsonian Institute and National Museum.—MAYNARD.—The first part of an illustrated article on the electrical collections.—*Elec. Rev.*, Jan. 3.

Paris Exposition.—An illustrated article referring chiefly to the electrical building and plant.—*West. Elec.*, Jan. 6.

New Book.

THE "MECHANICAL WORLD" POCKET DIARY AND YEAR BOOK FOR 1900. Containing a Collection of Useful Engineering Notes, Rules, Tables and Data. Manchester: Emmott & Co., Limited. 244 pages, 95 diagrams. Price, 6d.

This useful work, in view of the low price and large number of pages occupied by trade announcements, may be considered primarily as an advertising enterprise. Nevertheless the value of the 200 odd pages of engineering data which it contains is not affected by this consideration. The present is the thirteenth year of publication of the book, and as it appears to be edited with considerable care, the correctness of the standard tables, formulas, etc., contained may be taken for granted. Among new matter we note several useful tables on the horse-power required to drive various kinds of machinery. One of these tables is that of Flather and gives the horse-power for fifty or more different classes of machines. Another table relates to cotton machinery and a third to paper machinery.

BOOK RECEIVED.

CENTRAL STATION ELECTRICITY SUPPLY. By Albert Gay and C. H. Yeaman. New York: The Macmillan Company. 470 pages, 200 illustrations. Price, $3.00.

"Falcon" Direct-Current Power Motor.

The accompanying illustration shows a direct-current power motor manufactured by the Falcon Electric Manufacturing Company, 432 East Seventy-first Street, New York. As will be noticed, its design is compact and somewhat unique. At the present time it is manufactured in two sizes, namely, 1-12-hp and ⅛-hp, and is wound series or shunt for 115 volts, 230 volts or battery circuits. It is furnished with 1¼-inch grooved V-shaped pulleys, and has self-oiling

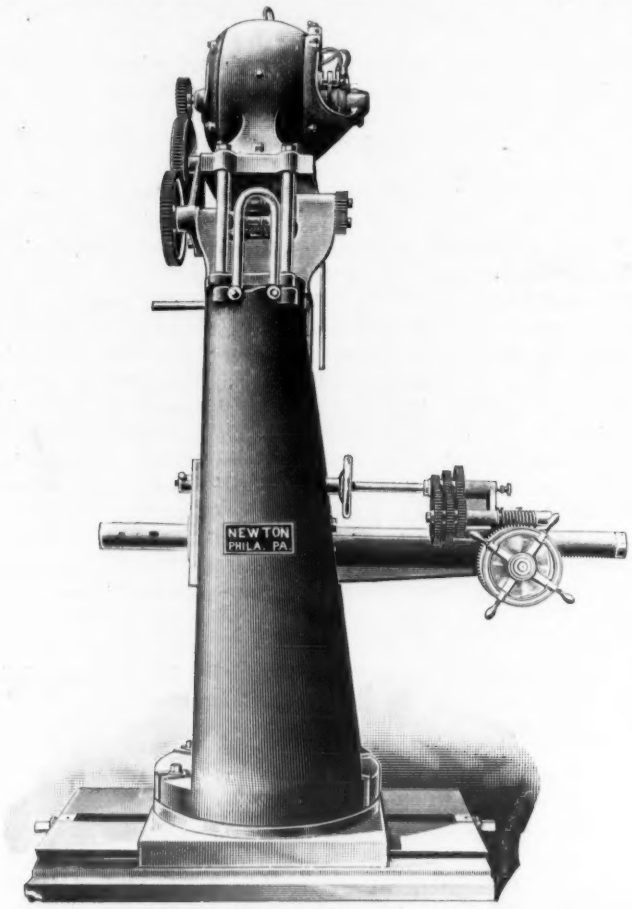
bearings and a substantial base. All the current-carrying parts are carefully protected to avoid short-circuits. The machine is finished

"FALCON" MOTOR.

in black japan. The company are also developing their smaller fan motors on the same general lines of design and construction.

Portable Boring and Milling Machine.

The General Electric Company is using, among its equipment of portable machine tools at its Schenectady works, a portable milling and boring machine manufactured by the Newton Machine Tool Works, Philadelphia, Pa., of which machine an illustration is given herewith. This machine has an assortment of feeds lengthwise of



PORTABLE BORING AND MILLING MACHINE.

the bar for boring and vertically for milling. One of its principal uses is the milling of dovetailed slots in the frames of large generators to which the pole-pieces are attached. The machine is mounted on a base-plate on which it has both a swiveling and a traversing motion. The capacity of the machine will be appreciated from the fact that the boring bar is of 4 inches diameter and has a longitudinal feed of 32 inches.

Cutter's "Strong Arm" Arc Hood.

One of the sources of annoyance to users of arc lamp hoods has been the weakness of the insulating cross-arm as commonly used over each hood. The George Cutter Company, of Chicago, offers a remedy for this in the form of what might well be called a "strong arm" arc hood. It consists of an arc lamp hood of the usual size and shape, with all parts of extra strength and good fit. The cross-arm bolted to it is coated with a baked enamel which withstands the action of rain, thus preventing the checking of the wood by the weather. Then to make doubly sure of the strength at the insulators, each end of the wood arm is bound by a heavy metal ferrule so that no amount of side strain can split the end and loosen the insulator. The George Cutter Company claim that others details of their hoods have been worked out on equally practical lines so as to make these hoods unusually durable and satisfactory.

ARC LAMP HOOD.

Portable Primary Battery.

The cuts herewith represent two styles of a portable primary battery manufactured by the Edison, Jr., Electric Light & Power Company, 27 William Street, New York. These batteries are designed for small electric light and small power work, although they can be utilized for heavier duty in both departments, if necessary.

The battery shown in Fig. 1 consists of four cells, the outside dimensions of the box being 6 x 4¼ x 4¼ inches. This battery was originally devised to supply current for a miner's hand lamp, and on short circuit gives 5 amperes at a pressure of 7.5 volts. It is stated that it will maintain a 3-cp lamp for 10 hours. Such an outfit is particularly useful in such places as powder factories, cotton gins, distilleries, flour mills and in factories, etc., where explosive gases are present. The lamp is hung on connections at

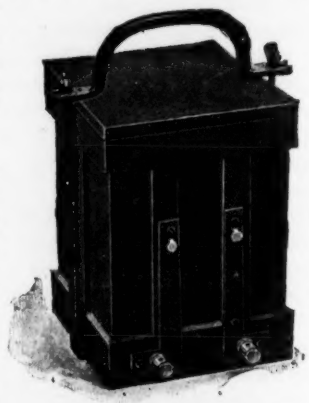


FIG. 1.—4-CELL BATTERY.

FIG. 2.—8-CELL BATTERY.

the front of the box and is backed by a parabolic reflector which concentrates the rays. It may, however, be hung on the wall or on a hook at any distance from the battery. This outfit is also

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valuable for the operation of surgical lamps and for throat and stomach examinations.

Fig. 2 shows a portable battery of eight cells having an e. m. f. of 15 volts, giving, on short circuit, 10 amperes of currrent. This style is intended for household use, and can be applied to the operation of a sewing machine, a fan, or for any other light power in housework. It will also light a 10-cp lamp.

These batteries are said to be easy to maintain. The wires and connections are placed at the bottom of the cell and coated with an acid-proof cement rendering them permanent and incorrodible.

The exciting liquid is dilute sulphuric acid, and the depolarizer is a solution of nitrate of soda. The elements are carbon and zinc. Prof. Silvanus P. Thompson is stated to have made some favorable remarks concerning the battery before the Woolwich commission appointed for the inspection of miners' lamps. He made a test of one of the batteries and, we are told, expressed great satisfaction with it.

Portable Searchlight Equipment for Fire Department.

In our issue of last week brief reference was made to a portable searchlight equipment for the New York Fire Department, which promises to form a valuable adjunct to the fire fighting apparatus. The illustration herewith is made from a photograph of the apparatus which now forms part of the equipment of Engine Company No. 20, on Marion Street, New York. The machine in general resembles an ordinary fire engine, the principal mod fication being the substitution of a dynamo with its driving engine for the usual steam pump, and the use of two searchlights, which are prominent features of the new apparatus.

PORTABLE SEARCHLIGHT APPARATUS OF THE NEW YORK FIRE DEPARTMENT.

The two projectors are of 6000-cp each, of the Rushmore marine type, the barrels being 18 inches in diameter. They set on pins rising from standards permanently attached to the frame of the machine, and can be turned to sweep a complete circle in a horizontal plane. The vertical movement is obtained by the fork suspension across the diameter of the barrel. The lamps are of special design in order to overcome the vibrations which are necessarily excessive in a machine of this character.

The projectors are located immediately behind the driver's seat, one on each side. They can be readily removed from the pin and placed on portable standards carried at the back of the machine, as will be explained later on. The left hand lamp is provided with diverging lenses which throw a "square" light on the face of a building, while the one on the right is an ordinary reflecting searchlight, whose rays may be dispersed or concentrated by the variation of the focus. The circuit of each lamp is opened and closed by a plug switch placed on the frame of the machine within easy reach of the operator. The rheostat is situated back of and between the two lights, and is readily accessible. It is enclosed in a water-tight box, but is at the same time well ventilated. Between the searchlights and the generator there are two Weston ammeters, one on each side, and on the left hand side of the generator is a Weston voltmeter. This is shown in the illustration. These instruments are placed at a height about equal to that of the average man, so that their readings can be easily noted by the attendant.

Current is generated by a Bullock ironclad multipolar marine-type generator driven by a Forbes upright engine, with 5x5 cylinder, working at 100 pounds pressure, and 650 r. p. m. The engine is direct connected to the dynamo, and there is a fly wheel between the two to take up any irregularity of motion. The dynamo maintains a pressure of 80 volts, each light taking 35 amperes of current.

At the back of the boiler on two uprights, one on each side, are two reels of double flexible conductor cables set on portable standards, each carrying 200 feet of cable. The reels can be removed from the standards, which are made to support the searchlights, and are themselves readily detachable to permit of their being placed, with the projectors, in the most advantageous position to facilitate the work of the firemen.

This portable searchlight equipment was built by the La France Fire Engine Company, of Elmira, N. Y., and while it is the first one turned out its compactness and excellence of finish reflect great credit upon all concerned in its design and construction. It has already proved itself to be a valuable addition to the fire department's equipment.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was not particularly active, only half as many shares being traded in as during the same week last year, when nearly 6,000,000 exchanged hands. Nor were prices high, and declines were numerous. Toward the close of the week there was improvement, justified in every way by the ease of the money market, by trade and by railway earnings. During the week, 3819 shares of Western Union were sold, closing at 87, and 2507 shares of General Electric, closing at 123, a gain of 1. On dealings in 258,000 shares Brooklyn Rapid Transit closed at 68¼, a decline of 3¼. Metropolitan Street Railway declined 9¾ to 165¾ on 30,197 shares. In Boston, American Bell Telephone closed the week at 332. Erie Telephone, 104-105; New England, 135-140; Michigan, 100-105; Mexican, 3-3¼; Boston Elevated, 96½; West End, 93, pref. 112; Mass. Elec. Railways, 21. In Chicago, National Carbon was quoted 82 pref., 18 common; Chicago Edison, 157-158; Union Traction, 76 pref., 27½ common; Lake street L 14¾-15; Metropolitan L, 75½ pref.; North Chicago, 220; South Side L, 99½; West Chicago, 109½. In Philadelphia, Electric Storage Battery closed at 75-75½ pref., 81-82 common; Penn. Elec. Veh. 3⅝ pref., 7⅛ common; Union Traction, 89; Phila. Traction, 96¼; Consol Traction, N. J., 62¼; Consol Traction, Pittsburg, 27⅛; General Elec. Automobile, 3⅝; Elec. Co. of Am., 13½; Am. Railways, 5⅛. In the New York outside market, Electric Axle Light & Power sold at 5-5¼; Electric Vehicle, 90-95 pref., 55-61 common; Elec. Boat, 36-42 pref., 21-24 common; N. Y. Elec. Veh. Trans., 10½-11½; New England, 6½-7¼; Illinois, 3-3¼; General Carriage Co., 7⅝-8.

GENERAL CARRIAGE CO. was favorably affected by the announcement of the plans of the company, in regard to the establishment at a very early date of the cheap cab service, which the company proposes to furnish in this city, an order having been placed for 200 electric vehicles of a Chicago make. Recent extraordinary manipulation of General Carriage led to the opinion on the part of many that the future of the stock was a most uncertain one, but these official announcements have given some reassurance. It is said that the present plans of those interested in the management of the company are entirely apart from the efforts recently made to establish fabulous prices for the stock. The cabs which the General Carriage Co. will put in use will consist of hansoms, broughams and landaus, operated by electricity. Under the charter the company is limited to charges of 75 cents per hour. These cabs have been tested in Chicago. Stable accommodations have been secured in Fiftieth Street. It is officially announced that Edwin Gould has privately purchased what amounts to the controlling interest in General Carriage.

CONSOLIDATION IN KANSAS CITY.—By the action of the directors of the Edison Electric Light & Power Company and the Kansas City Electric Light Company, the electric lighting business of Kansas City, Mo., has passed into the control of the Armours of Kansas City and Chicago, Robert Fleming of London, C. E., and W. H. Holmes of the Kansas City Metropolitan Street Railway Company, and other local business men. The principal owner of the two companies was the United Gas Investment Association. This company has surrendered its control, and the heaviest individual stockholders, Winthrop Smith and W. N. Coler, the Philadelphia and New York bankers, withdrew. The investment now is more than $1,000,000. Half a million dollars more will be put into improving and extending the service and bringing it up to date.

ELECTRIC AXLE LIGHT & POWER.—The management has, it is said, adopted plans to reduce the capitalization of the company and to make its stock upon the payment of the second call of $5 due Feb. 15, full paid and non-assessable. It seems to be favorably received. Apprehension as to further calls on stocks of this class has been one of the chief causes affecting the prices of the stocks issued on the plan similar to that on which the Electric Axle Company was formed, and the fact that the stock will be made full paid will, it is thought, considerably improve the market for this issue. Work has of late been pushed very vigorously and successfully on the company's car refrigeration system.

NEW ORLEANS RAILWAY CONSOLIDATION.—There is no doubt that a movement is on foot to consolidate the street railways of New Orleans under the title of the New Orleans City Railway Company. A director of one of the largest railways says he believes the combination will be effected about April or May. The New Orleans City Railway will be the key of the system and it is expected the stock will have a great advance if the scheme goes through.

RICHMOND RAILWAY CO.—A meeting of the bondholders of the Richmond Railway & Electric Company has been held for the purpose of meeting a committee appointed by the Richmond Passenger & Power Co., of Richmond, Va., which has just obtained a franchise for three years from the city of Richmond, which covers an important section of territory now operated by the Richmond Railway & Electric Co. Some adjustment is necessary.

BROOKLYN LIGHTING INTERESTS are brought into close harmony with those of New York City by the election of Mr. A. N. Brady as president of the Kings County and Brooklyn Edison Companies; he being already president of the New York Gas & Electric Light, Heat & Power Co. Changes have been made in the directorates to render such co-operation as may be intended easy and efficient.

DIVIDENDS.—The Citizens' Telephone Company, of Grand Rapids, has declared a quarterly dividend of 2 per cent. Denver Gas & Electric Company has declared a dividend of 1½ per cent., payable February 20. The Baltimore National Automatic Fire Alarm Company has declared its usual semi-annual dividend of 1½ per cent., payable Feb. 1, 1900.

WARREN ELECTRIC & SPECIALTY CO., of Warren, O., has increased its capital from $100,000 to $200,000, to take care of increasing business.

Commercial Intelligence.

THE WEEK IN TRADE was marked by quiet and by equal hopefulness. The recent period of book balancing and stocktaking seems to be yielding good figures. In the electrical field, the output of the year is found to have been enormous. The General Electric alone places its sales at not less than $25,000,000. Another manufacturer informs us that his figures show 60 per cent. increase over the preceding best year, and there is every reason to believe that such results prevail all along the line. A good deal of new work is offering in every electrical branch and prices are in general well maintained. Trade throughout the country is active, sound and steady. Gross railway earnings for December make a favorable showing. The total earnings of 104 roads for the month aggregate $56,396,942, a gain of 7.6 per cent. over December, 1898. For the twelve months the earnings of 102 roads were 9.7 per cent. in excess of 1898, and, combining with the returns of the calendar year, those of a few large systems for eleven months an aggregate of gross receipts is obtained of $1,065,000,000, a sum equal to 75 per cent. of the total earnings of the country's railroads, and which indicates an increase for 1899 on all roads of about 10 per cent. As to bank clearings, Bradstreet's reports that they show for the week a small expansion. Owing mainly to exceptional activity in the stock market a year ago, there is a decrease reportable from the second week of January, 1899. The aggregate for last week is $1,869,300,836, a gain of 4.4 per cent. over last week, but a decrease of 3.6 per cent. from a year ago. Compared with 1898 there is a gain of 29 per cent., and with 1897 the increase is 78 per cent. Current clearings are double those of the same week of 1894 and 32 per cent. in excess of the corresponding week of 1892. The week's failure returns reflect the annual clearing out of delinquent traders in a total for the week of 295, as compared with 229 the previous week, 323 in 1898, 478 in 1897 and 412 in 1896.

B. F. STURTEVANT APPARATUS.—A recent visit to the B. F. Sturtevant Company's plant, at Jamaica Plain, Mass., proved very interesting. The thoroughness with which the work is done, the rapidity with which it is turned out, and the immense variety of the line being such as to astonish any layman who may be fortunate enough to be conducted through the plant. As an example of the rapidity with which work is turned out in this establishment, a representative of this journal who called there was shown a 140-inch steel plate fan, intended for ventilating purposes, weighing over 5000 pounds, the parts for which were cast the day before he called, and erected the day he was there. In other words, thirty-six hours before he saw the completed fan practically ready for shipment, the castings had not been made in the foundry. The diversified character of the line may be seen from the fact that there is now under course of construction in the works such variety of apparatus as the following: Twenty-six engines of 100-hp with a base space of five feet by three feet and a weight of 3250 pounds each (a phenomenally small space and light weight for engines of such capacity.) These engines are intended for use in the two American Line steamers now being built on the Clyde, and they are the only American machinery going into these ships, with the exception of the gener-

ators which are being built by the Electro-Dynamic Company, of Philadelphia. Ten of these engines are intended for driving the generators and sixteen of them for forced draft fans. Sixty engines and fans for the new United States torpedo boats, three complete lighting equipments for the United States torpedo boats, six generating lighting sets for the Brooklyn Navy Yard to be used in new warships, two 25-hp electrically driven fans for ventilating purposes upon the United States battleship Illinois, four fans, four engines and the complete heating and ventilating equipment for the United States army transport Sumner, ten large electric fans for ventilating mines in Mexico, two 140-inch electrically driven fans for the Edison Illuminating Company, New York, four 240-inch fans for induced draft on boilers of the Spreckels plant, San Francisco, four 120-inch fans for forced draft on the boilers of the Brooklyn Heights Railway Company's plant, and two electrically-driven fans of 240 inches for forced draft on the boilers of the Chicago Construction Company's plant. They make a special line of motors for use in connection with the B. F. Sturtevant fans from 1-6-hp to 125-hp. These motors are being built in the various sizes in addition to the above work mentioned, besides the large business they are doing in heating apparatus. Over 900 steam engines were built and shipped in 1899, an average of over three complete engines per working day.

WAGNER ELEC. MFG. CO.—The annual meeting of this company occurred Jan. 8, in St. Louis. The old board of directors, as well as officers, were re-elected as follows: S. M. Dodd, president; James Campbell, vice-president; S. B. Pike, secretary and general manager; W. A. Layman, treasurer and assistant general manager; Ferd Schwedtmann, general superintendent; E. H. Abadie, manager sales department. Directors, S. M. Dodd, James Campbell, James W. Bell, J. C. Van Blarcom, S. B. Pike, Ferd Schwedtmann, H. A. Wagner. The reports of the officers there represented showed an increase in the company's business during 1899, as compared with 1898, of 68.5 per cent. By vote of the board a dividend of 8 per cent., payable March 10, was declared. During the year there have been many rumors current to the effect that the majority of the stock holdings of the Wagner Co. had been disposed of to some of the company's Eastern competitors and that the business was now fully under control of these competitors. All these rumors have been absolutely without foundation. The stock is held entirely by St. Louis parties and the officers and directors of the company are all representative St. Louis business men. The year just closed has been one of the most successful in the history of the company, being specially marked by a large number of important contracts calling for a high grade of engineering work.

ELECTRICAL EXPORTS FROM NEW YORK.—The following were the exports of electrical material from New York during the week ended January 13, 1900: Antwerp—76 cases electrical material $4882; 4 cases electrical machinery $1350. British Possessions in Africa—9 cases electrical material $2196; 43 cases electrical material $1884. Barcelona—65 cases electrical material $2797. British West Indies—11 cases electrical material $269. British East Indies—2 cases electrical material $118. Bremen—1 case electrical material $700; 1 case electrical machinery $1078; 208 cases electrical material $1384. Charleroi—1 case electrical material $40. Chili—13 cases electrical material $29. Cuba—226 cases electrical material $1007; 2 cases electrical machinery $222. Dutch West Indies—1 case electrical material $12. Ecuador—1 case electrical material $17. Glasgow—57 cases electrical material $3967. Hong Kong—1 case electrical material $8. Havre—733 cases electrical material $76,496. Hamburg—109 cases electrical material $9410. Japan—44 cases electrical material $4209. Mexico—65 cases electrical material $2844. Puerto Rico—7 cases electrical material $97. Peru—13 cases electrical material $340. Philippines—16 cases electrical machinery $5127. Stockholm—1 case electrical material $120. Siam—56 cases electrical material $893. Southampton—20 cases electrical material $950. U. S. Colombia—90 cases electrical material $2566.

USE OF NIAGARA POWER.—At a recent meeting of the Acheson Graphite Company a dividend of 3½ per cent. was declared. This shows a very gratifying condition of the company's business considering the company was not incorporated until January 26, 1899. At the same meeting referred to it was decided to enlarge the company's plant at Niagara by the construction of a large new building to occupy the balance of the plot the company leases from the Niagara Falls Power Company. When the new building is up—and work will be commenced at once—the company will use an additional 1000-hp, mainly for the manufacture of graphite anodes and electrodes, while the manufacture of graphite will be further exploited and the product placed on the market. The extended improvements to the lower works of the Pittsburg Reduction Company have been nearly completed and quite a large number of new pots are now in use. A floor has been elevated and a new system of ventilation installed. By this system the fresh air enters the plant beneath the floor and, passing through the factory building, leaves it through a high ventilating shaft now being built. When all the new features are completed and in use, it is expected that the company will be able to consume about 10,000 electrical hp in this single plant, which is located on the property of the Niagara Falls Hydraulic Power & Manufacturing Company.

PLANT FOR KANSAS CITY LIGHTING.—With regard to the recent consolidation of electric lighting interests in Kansas City, Mo., it is now announced that the veteran, E. R. Weeks, past president of the National Electric Light Association, is to be general manager of the larger system, as he was of the old one. Mr. E. R. Richardson, of Pierce & Richardson, Chicago, has been retained as consulting engineer to advise on the expenditure of $500,000 in betterments and the readjustment of the plant. President C. F. Holmes says: "The policy of the new company will be to develop the electrical supply system of Kansas City to the highest point of excellence. We are going to make a specialty of supplying power to manufacturers. This is something that has never been done before and it will have a very great influence in bringing to Kansas City a vast number of smaller factories that demand an adequate power supply at a small cost. It will tend to make Kansas City a great manufacturing center. The reconstruction of the system will cost in the neighborhood of $500,000, and this sum will be spent at once in the development of our plans." A good deal of the present apparatus is time worn if not exactly obsolete. It was in Kansas City that the old Thomson-Houston system got one of its first big booms.

CONSOLIDATION OF SWITCH MANUFACTURING COMPANIES.—Waldo C. Bryant, Edward W. Marsh and L. W. Eaton, of Bridgeport, Conn., have purchased a controlling interest in the Perkins Electric Switch Manufacturing Company, of Hartford. Edward W. Hooker and Charles G. Perkins have retained a sufficient interest in the company to remain in the directorate. Secretary Hooker, who has held that position for four years, will retire from active management. Thomas W. Hooker, his brother, will also retire. New officers will be elected at once. Mr. Bryant will be chosen president. Mr. Greer, of Chicago, who has had charge of Mr. Bryant's Western interests, will have the management of the Hartford plant. Mr. Bryant will spend one day each week in Hartford and will retain his residence in Bridgeport on account of the Bryant Electric Company's factory, which requires much of his time.

ROBBINS & MYERS CO., of Springfield, O., have issued a notice to the trade in regard to their recent improvements, as follows: Our fan and motor business has increased so rapidly, and grown to such an extent, that we have found it impossible to handle it properly in the plant and with the equipment originally provided. We have, therefore, added a new and complete factory to the former plant. This factory has a floor space of 30,000 square feet and is being fitted with the most modern equipment throughout and will be used exclusively for the building of ceiling, desk and bracket fans, motors and dynamos. Our castings are made in our own foundries which adjoin the new factory.

APPARATUS FOR ALBANY.—The United Traction Company, formed by merging the Albany and Troy City and Cohoes Railways, has, through its directors, authorized the issue of $1,000,000 in new stock with which to pay for re-equipping the Troy division of the company, improvement of property, and retirement of old Troy City debentures. F. N. Mann, Jr., of Troy, was named vice-president, to succeed Charles Cleminshaw, resigned. The directors decided to purchase twenty-five new open cars and thirty-five box cars.

THE NEW EDISON STATION.—Plans have been filed with Building Commissioner Brady by the architect of the New York Edison Electric Illuminating Company for its new power house, which will occupy the entire block from First Avenue to the East River, between Thirty-eighth and Thirty-ninth streets. It will be a three-story structure of brick, trimmed with granite, and will cost $809,000. Details of the work have been given in these pages.

TROLLEYS IN JAPAN.—The various companies organized to build electric lines in Tokio consolidated under the name of the Tokio Street Railway Company, will build 200 miles of track. They are to begin work at once, and will soon purchase track material. The entire 200 miles is to be completed in six years, and in that time their requirements will reach about $7,000,000. In Yokohama an extensive electric street railway system is also proposed.

COPPER AND BRASS.—Brass manufacturers have reduced their schedule of prices to about 16¾c. net for sheet brass, and it is said that orders which have been held back on account of high prices should become more plentiful. Copper holds firm at 16½c. for Lake.

AMERICAN AUTOS IN GERMANY.—A special cable despatch from Berlin, of Jan. 11, says: Considerable fear is expressed in the German press that American automobiles will invade Germany, and a higher duty is demanded.

THE WESTERN ELECTRIC COMPANY has closed a contract with Carson, Pirie, Scott & Co., of Chicago, to install a 150-kw, direct-connected Western Electric generator.

Special Correspondence.

NEW YORK NOTES.

New York, Jan. 16, 1900.

"XELTON."—Some months ago a notice appeared in these columns of the organization in New Jersey of a company to manufacture a compound called "Xelton," which was said to be a substitute for hard rubber. We have an inquiry for further information as to the company and the compound.

BROOKLYN RAPID TRANSIT APPOINTMENTS.—Mr. W. T. Goundie has been appointed general superintendent of the elevated railway lines controlled by the Brooklyn Rapid Transit Company. Mr. Eugene Chamberlain has been appointed superintendent of equipment of the same company.

MEDICAL ELECTRICITY.—Dr. Robert Newman, ex-president of the American Electro-Therapeutic Association, will deliver at his house, 138 West Seventy-third Street, New York, on Jan. 25, at 8:30 p. m., a lecture on the medical applications of electricity, including X-rays, accompanied by experiments. Dr. Newman states that he shall be glad to receive any of our readers who may be interested.

THE MAIN DYNAMO switchboard in the station of the United Electric Light & Power Co., at Twenty-ninth Street and the East River, was burned out on Monday night, Jan. 8. The accident happened at about the time the theatres were opening, and several of these places of entertainment, which depended upon this station for light, were in darkness for about half an hour. Many of the advertising signs along Broadway were also in the outer darkness. The theatres resorted to gas illumination during the break.

FRANCHISES SIGNED BY THE MAYOR.—Mayor Van Wyck has signed the resolution of the municipal assembly granting two franchises to the Metropolitan Street Railway Company and the Third Avenue Railroad Company through King's Bridge Road and Eleventh Avenue, and across the Spuyten Duyvil Creek to the city line. The board of estimate and apportionment has fixed the rate of compensation to the city at 4 per cent. of the gross receipts for the first five years, 6 per cent. for the next five, 8 per cent. for the next five, and 10 per cent. thereafter. The franchises are for 25 years, with the privilege of another 25 years' renewal, subject, however, to a reappraisement by the city.

A POSSIBLE RIVAL ELECTRIC-GAS COMPANY.—From a statement made by Gen. James Jourdan, president of the New Amsterdam Gas Company, it is inferred that his company may also compete with the Consolidated Gas Company in the electrical field, the last named company having acquired control of the New York Gas & Electric Light, Heat & Power Company. The New Amsterdam Company, Gen. Jourdan stated, through owning the franchise of the East River Gas Company, is authorized to make and sell electricity as well as gas, and, under a special act passed by the legislature in 1892, is permitted to build its own conduits for wires. The existing subways, he said, could be used if necessary without any trouble, and experts have been at work drawing plans for the erection of an electric plant on the other side of the East River and the installation of electric wires over a large portion of the city.

TRAFFIC ON ELEVATED AND SURFACE LINES.—The report of the state board of railroad commissioners for the year ending June 30, 1899, shows that the number of passengers carried by the elevated railroads during the year was 213,248,419, a decrease of 14,528,133 as compared with 1898. This decrease is in large part accounted for by the fact that the returns of the Brooklyn Elevated Railroad Company and its successor, the Brooklyn Union Elevated Railroad Company, cover a period of but nine months, the other three months' statistics being included in the report of the Brooklyn Heights Surface Railroad. The number carried by the Manhattan Railway was 174,324,575, a decrease of 9,036,271 as compared with 1898. The number of passengers carried on the street surface railroads, including the few remaining horse railroads, in the boroughs of the Bronx and Manhattan, New York City, including "transfers," was 509,314,816, an increase over 1898 of 52,351,063. The number carried in the Borough of Brooklyn (including some carried in the Borough of Queens), including "transfers," and including those carried during the last three months of the year by the Brooklyn Union Elevated Railroad was 238,721,051.

INCANDESCENT LAMPS.—Some definite and interesting information on this subject was given to the members of the Brooklyn Institute of Arts and Sciences last week in a talk on the manufacture and uses of the incandescent lamp by Mr. William S. Barstow, the general manager of the Edison Electric Illuminating Company, of Brooklyn, in the Art Building, on Montague Street, under the auspices of the department of electricity of the institute. Not only did Mr. Barstow talk about incandescent lamps and their manufacture, but he showed exactly how it is done with exhibits of filaments, bulbs and different parts treated in the process. Then he had various specimens of lamps, some of them the ordinary bulbs that are to be seen everywhere, and other lamps for special purposes and of a peculiar style. There was a buoy lamp, for instance; a diving lamp, a reflector lamp, a set of five types of multiple candelabra lamps, a torpedo lamp, a kinetoscope lamp, a bicycle lamp, dental, surgical, pea, microscope and many other sorts of lamps. There was a miner's lamp and even the new lamp that is used on telephone switches in this city. In talking about them Mr. Barstow said: The incandescent lamp is now in its twentieth year and from its beginning at Menlo Park, the progress has been rapid, until at the present day the total production in the United States alone is about 20,000,000 lamps per year, and the different varieties and forms in which the lamp appears number over 147,000. From a few hundred dollars during the first year the amount expended for lamps has annually increased, until during the past 12 months there will have been expended about $4,500,000. The price of the lamp itself has been reduced from $1 to an average of 18 cents per lamp, and even at this low figure the profit is quite as much as in the early days.

NEW ENGLAND NOTES.

Boston, Mass., Jan. 13, 1900.

SAMSON CALENDAR.—The Samson Cordage Works, Boston, Mass., has issued a unique 1900 calendar. It consists of a cardboard frame with removable monthly calendars, and is fitted with a back support, so as to stand on the desk or table like an easel. At the top of the calendar is a short length of clear celluloid tubing containing a sample of Samson Spot Cord. It is a good idea.

THIRD RAIL LINE TO LENOX.—Summer residents of Lenox have interested the Consolidated Railroad in their struggle against the extension of the lines of the Pittsfield Electric Street Railway Company to Lenox, and it is understood that the Consolidated Road will construct and establish a third rail system between Pittsfield on the north and Great Barrington on the south, passing through Lenox, Lee and Stockbridge. It is understood that the Adams Express Company, through some of its directors who are Lenox cottagers, has also exerted a strong influence on the directors of the Consolidated Company to establish the system, which it is expected will be in operation within six months.

ELECTRIC RAILWAY WORK.—The gross earnings and car miles of the 39 companies comprising the Massachusetts Electric Companies, for December, 1899 and 1898, are as follows:

	1899.	1898.	Inc.	Per cent.
Gross earnings	$347,330	$302,164	$45,166	14.95
Car miles	1,545,204	1,506,525	38,679	2.57
Receipts per car mile.	.2248	.2005	.0243	12.11

For the three months ending Dec. 31, 1899, and Dec. 31, 1898:

	1899.	1898.	Inc.	Per cent.
Gross earnings	$1,045,489	$924,408	$121,081	13.10
Car miles	4,586,927	4,438,225	148,702	3.35
Receipts per car mile.	.2279	.2083	.0196	9.41

PENNSYLVANIA AND OHIO NOTES.

Philadelphia, Pa., Jan. 15, 1900.

MR. JOHN L. HALL, sales manager Bullock Electric Manufacturing Company, Philadelphia, Pa., attended the meeting of the representatives of the Bullock Company, which was held at Cincinnati on Jan. 9 and 10.

THE CUTTER COMPANY has removed its factory to the corner of Nineteenth and Hamilton streets, Philadelphia, where it has largely increased facilities for the production of I-T-E circuit breakers and C-S switches.

THE HIGH TENSION ELECTRIC STORAGE COMPANY.—The personal property of the High Tension Electric Storage Company, of Souderton, Pa., has been sold under bankruptcy proceedings. The company has discontinued business.

A HANDSOME CALENDAR.—The Cutter Company has brought out a handsome calendar for 1900. Each monthly sheet has a large illustration of a particular type or style of the I-T-E circuit breaker, with a few words of descriptive matter. The calendar is printed in black and red, and is very attractive.

HARD FIBRE FIRE.—A despatch from Wilmington, Del., of Jan. 10 says: The large plant of the Delaware Hard Fibre Works, in the western part of the city, caught fire late to-night, and at midnight it was stated the factory would be destroyed. All the fire companies are on the scene. The estimated loss is $125,000; covered by insurance.

THE PENNSYLVANIA STATE CONSTRUCTION COMPANY, general contractors, with office at 735 Drexel Building, Philadelphia, Pa., have just been organized to do a general contracting business, making a specialty of electric street railways and lighting plants. Mr. Joseph MacCarroll, its president, was formerly president of the Fairmount Construction Company; Mr. James W. Perry, treasurer, has been for years, and is now, connected with the H. W. Johns Manufacturing Company, and Mr. Joseph Sutter, secretary, is engaged in the real estate business at Ocean City, N. J. Mr. George F. P. Wanger, engineer, was formerly connected with the Fairmount Construction Company.

Pittsburg, Pa., Jan. 13, 1900.

THE WEST END STREET RAILWAY COMPANY will at once extend its line by the addition of a six-mile branch from the West End to Banksville and Mount Lebanon.

TO EXTEND WESTINGHOUSE WORKS.—The Westinghouse Electric & Manufacturing Company has advertised for bids to add another extension to the East Pittsburg factory, comprising 200 feet, to the warehouse and a roof over the vacant space between the machine shop and the warehouse, which latter improvement will really add another complete shop to the factory. When this work is completed the Westinghouse machine shop, the warehouse and the power house will practically form one large building, 1250 x 400 feet, with over half a million feet of floor space.

THE PITTSBURG & BUTLER ELECTRIC RAILROAD COMPANY held their first annual meeting yesterday. This is the company which has projected the construction of an electric line from this city to Butler, a distance of some 40 miles. The charter was obtained last July, and all preparations have now so far completed so as to enable the company to begin work on the building of the line right away. At the meeting yesterday of the stockholders, Mr. Henry Whittmer was elected president, and the following gentlemen were elected directors: F. B. McMillan, X. Whittmer, Henry Whittmer, George D. McMorran, George D. Chalfant, R. A. George, F. L. Harlinghouse, F. Klussman and D. C. Cawley. The office of the company is at No. 12 Federal Street, Allegheny City.

Cincinnati, Ohio, Jan. 13, 1900.

THE ELECTRIC RAILWAY EQUIPMENT COMPANY, William A. McCallum, manager, shipped this week a big consignment of poles to be used in the enlargement of the Union Street Railway Company's service at New Bedford, Mass.

MANAGER W. F. HAYS, of the General Electric Company, reports a constantly increasing business for January. City Salesman F. A. Kelly is on a trip through Ohio. H. A. Smith and J. L. Merrill, Ohio and Indiana agents, are in the city to-day.

THE ELECTRIC APPLIANCE COMPANY is shipping all the equipment it can turn out, mostly for telephone service. Mr. Maish and Mr. Churcher have demonstrated not a little keenness and foresight in the establishment and conduct of their rapidly growing business.

AN ATTACHMENT was levied by Deputy Sheriff Cormany, of this county, Thursday on over $1000 worth of electric machinery, which was just ready to load on a steamer. The action was brought by John L. Lincoln, assignee of the Nowotny Electric Company, vs. Jett Bros.

THERE IS NOW every certainty that the old compact between the Edison Electric Company, the Jones Bros.' Company and the Cincinnati Gaslight & Coke Company will not be renewed next Thursday, when it expires by limitation (five years). Circulars have been sent out by the Edison Company, offering consumers the advantage of a material reduction in service, which now costs 15 and 10 cents per kilowatt.

MEETING OF BULLOCK REPRESENTATIVES.—A particularly felicitous occasion was the agents' meeting on Tuesday and Wednesday, Jan. 9 and 10, at the works of the Bullock Electric Manufacturing Company. President Bullock, Vice-President Neave and all the other officials were home and participated, and, with the able assistance of Advertising Agent Bolles, saw that all the visiting guests had an excellent time. Existing conditions were discussed, both from the manufacturing and the sales' standpoints; technical papers were read by the company's engineers and superintendent; practical demonstrations made at the works of the Bullock inventions, including the new teaser equipment. The guests were entertained with a dinner at the Queen City Club on Wednesday evening and the affair was very appropriately and enjoyably terminated with an excellent vaudeville entertainment, selected with an especial regard for electrical temperaments and constitutions. Agents present were George H. Berg, of Boston; Robert T. Lozier, of New York; Mr. Hall, of Philadelphia; J. A. Summers, of Knoxville; George McKinlock, of Chicago; D. S. Sprague, of Marietta, Ohio; J. H. Van Sickle, of Chicago; E. Reuber, of St. Louis, and Frank E. Perry, of Cincinnati.

Cleveland, Ohio, Jan. 15, 1900.

THE SIDNEY TELEPHONE COMPANY, of Sidney, has increased its capital stock from $30,000 to $40,000.

THE CANTON & MASSILLON ELECTRIC RAILWAY was somewhat crippled last week by a fire which destroyed its car barns and a number of cars. The loss was fully covered by insurance.

NEW TELEPHONE COMPANIES.—The Newcomerstown Home Telephone Company was incorporated for $25,000 last week; the Uhrichsville-Dennison Home Telephone Company for $40,000; the Canal Dover Home Telephone Company for $40,000, and the Saint Paris Telephone Company for $15,000.

THE NEW YORK & OHIO COMPANY, of Warren, manufacturer of the well known Packard lamp, has been awarded a large contract over many other competitors, to furnish the incandescent lamps for the lighting of the American Building at the Paris Exposition. The contract is a great plum for this well known company.

SECOND BURN OUT.—For the second time within three weeks the big 2400-kw General Electric generator at the main power house of the Cleveland Electric Railway Company burned out on Thursday last, causing an extensive tie-up. The work of repairing the first burn out was only completed a few days ago and the men from the General Electric Company's factory at Schenectady had not returned.

ELECTION OF OFFICERS.—The directors of the Toledo & Western Electric Railway Company, which was incorporated for $1,800,000 a few days ago, held a meeting in Cleveland last Tuesday and elected G. E. Herrick president; James R. Seagrave, vice-president; F. G. Seagrave, secretary and treasurer. The plans for the construction work have been completed and it is expected that contracts will be let in the near future. The road will run from Toledo to Morenci, Mich., and from there to Adrian. It is planned to have the road in operation by June 1.

THE YOUNGSTOWN TELEPHONE COMPANY, of Youngstown, will put a new exchange in operation in a few days. The underground cable has all been laid and the aerial lines are nearly completed. The switchboard has been put into place and the other exchange appliances are nearly ready. The switchboard is being installed by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago, and the work is in charge of W. E. McCormick, superintendent of the company's switchboard department. The board is of the central energy system type and accommodates 1800 subscribers. It is stated that this will be one of the finest plants of its size in the country.

NEW POWER HOUSE.—The Cleveland, Berea, Elyria & Oberlin Electric Railway Company has let contracts for the erection of a new power house at Elyria. When completed this will be the main power house of the company's system, since Elyria will be the radiating point of the various branches which are now under construction. One branch will run from Oberlin to Wellington, another from Elyria to Amherst and from that point to Lorain. It is interesting to note that the new lines will be equipped with aluminum feed wires. The equipment of the new plant will consist of two 500-kw direct connected generators operating at 90 revolutions, a 750-hp engine and appropriate batteries of boilers. The contract for generators has been placed with the Westinghouse Electric & Manufacturing Company, and for the boilers with the Sterling Company, but the engine has not yet been contracted for.

WESTERN NOTES.

Chicago, Ill., Jan. 13, 1900.

FENDERS FOR AUTOMOBILES.—An ordinance has been introduced in the city council requiring that automobiles be equipped with fenders.

THE CHICAGO ELECTRICAL ASSOCIATION will hold its next meeting on the evening of Jan. 19, at 8 o'clock. Mr. Bion J. Arnold will read a paper on "The Arnold System of Power Station Construction."

RAILWAY PROPERTY BURNED.—The barns of South Chicago City Railway Company at Holman and Sheffield avenues, Hammond, Ind., were destroyed by fire Jan. 9, causing a loss of about $130,000. Besides the barn, 32 cars, including a number of motor cars, sweepers, sprinklers and a large quantity of apparatus, were reduced to ashes.

INSPECTION OF ELECTRICAL PLANTS.—The majority of the senior class in electrical engineering at the University of Illinois, in company with Prof. William S. Aldrich, the head of the department, visited a number of the more important electrical industries and electric light and power plant installations in the city of Chicago during the holiday vacation.

EARNINGS OF THE LAKE STREET ELEVATED RAILWAY.—At the annual meeting of the stockholders of the Lake Street Elevated Railroad Company held a few days ago President D. H. Louderback presented a statement showing that the road, after meeting all fixed charges, had a surplus of $3639 as a result of its operations in 1899. The gain in average daily traffic in 1899 was 3318 as compared with 1898. The net earnings increased from $308,456 in 1898 to $365,960 in 1899.

COPPER WIRE THIEVES.—A few days ago a half-mile of copper wire was cut from the poles of the Chicago & Milwaukee Electric Railway Company between Winnetka and Kenilworth, and 800 feet of telephone wire was stolen, to the inconvenience of the Chicago Telephone Company's patrons in the southwestern part of the city. It was not until after many complaints had reached the Canal exchange that the absence of the telephone wire was discovered. Then linemen found that a section of the copper metallic circuit had been severed and removed bodily. The electric railway company offers $100 reward for the capture of the thieves who took their wire.

MR. CHARLES A. ROLFE, formerly president and general manager of the Rolfe Electric Company, Chicago, has taken exclusive charge and control of the protector department of the Eureka Electric Company. This company has the exclusive rights for manufacturing under the Rolfe and Barrett patents protective devices for telephone and telegraph circuits, cable heads, cable terminals, and heat coil apparatus. It is stated that these goods are in use in over 100 of the leading cities of America. Mr. Rolfe is one of the oldest telephone men in America, and is quite well known throughout the East, he having been formerly associated with the Gamewell Fire Alarm Telegraph Company, as well as Utica Fire Alarm Telegraph Company. The Eureka Electric Company is now distributing matter describing these devices, and will be pleased to give special information upon application.

GRADED STREET CAR FARES.—Two important propositions regarding graded fares on Chicago street car lines are to be made within 30 days. It is said on high authority that the Union Traction Company will announce a graded fare on certain portions of its system, according to the length of the haul, as a means of checkmating the growing demand for transfers. The Chicago General Company, which operates in the southwestern part of the city, has adopted graded fares and Vice-President Bonney said that the practice of giving reduced fares on portions of the system was about to be extended. This company has just adopted a rate of seven tickets for 25 cents, or a 3½-cent fare without transfers, on certain lines, and on other lines is carrying passengers for a 2-cent fare without transfers. On the main Twenty-second Street line the single 5-cent fare is still in force. It is stated that the company was seriously considering a reduction of all fares to a uniform 3-cent basis without transfers. The reduced fares have resulted in largely increased revenues and if the 3-cent rate is adopted it will be put in force in the near future.

Milwaukee, Wis., Jan. 12, 1900.

ELECTRIC LIGHT AT TWO RIVERS.—The Common Council of Two Rivers has approved plans for an electric lighting system.

MR. A. T. ALLEN, of Pittsburg, has taken the management of the La Crosse Telephone Company of La Crosse. This is an independent company.

THE MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY will soon build an extension to its South Milwaukee line to the United States Glue Company's factory, at Corrollville, two miles further south. The company has applied to the city of South Milwaukee for the franchise needed within the limits of the city and Corrollville.

THE MICHIGAN TELEPHONE COMPANY completed its long-distance line from Mackinaw City into Marquette on Jan. 11. The line is new through to Detroit, except for a small gap between Mackinaw City and Pellston, and as soon as that is completed the entire Upper Peninsula division between Marquette and the straits will be open for business.

NEGOTIATIONS HAVE BEEN practically completed for the transfer of the property of the Appleton Edison Electric Company, of Appleton, to the Fox River Valley Electric Company, which operates the interurban road between Appleton and Neenah, and is controlled by the officers of the Milwaukee Electric Railway & Light Company, of Milwaukee. The transfer will include the city street car system, and the lighting plants. The Fox River Valley Electric Company will take possession early in January. The city system will be greatly improved, and the tracks will in all probability be entirely rebuilt. Extensions will also be made. It is understood that one reason for the taking up of the franchise of the Appleton Company is that a means of shutting off of competing lines which have considered the proposition to build from Neenah to Kaukauna is thereby provided. The Fox River road, with its branches, will now control the approaches to the city.

Minneapolis, Minn., Jan. 12, 1900.

THE HOME TELEPHONE COMPANY, with lines in Western Iowa and South Dakota, has sold out to its big rival, the Iowa Telephone Company, a Bell concern. The deal includes the toll lines of the Iowa & Dakota Telephone Company.

THE CLEAR LAKE ELECTRIC LIGHT & POWER COMPANY, Clear Lake, Ia., will double the capacity of its plant and the capital stock will be increased from $10,000 to $20,000.

AN ELECTRO-CYANIDE PLANT is being put in at Mystic, S. D. The building is nearly completed. It will be a custom mill and will have a capacity of 75 tons of ore a day. All classes of ore except lead will be treated.

THE PEOPLE'S TELEPHONE COMPANY, of West Superior, Minn., is installing its new switchboard. The central energy system will be used. Thirty-five dollars per year will be charged for telephones by the new company.

THE NORTHWESTERN TELEPHONE COMPANY has been setting poles by day and the city engineer of Minneapolis digging them up at night. The police finally arrested several of the telephone company's employees. The telephone company has since brought a damage suit against the city, claiming that it has the right to set poles and string wires without first securing permission from the council.

Indianapolis, Ind., Jan. 13, 1900.

INCREASE OF CAPITAL.—The Citizens' Telephone Company, of Decatur, has increased its capital stock from $3600 to $6000.

THE NEW TELEPHONE COMPANY, known as the Anderson Telephone Company, has opened up for business in Anderson. The service is satisfactory, the plant working perfectly.

GOVERNMENT MAIL TROLLEY ROUTE.—The Interurban Electric Railway line between Goshen and Elkhart has secured a contract from the government to carry the mails.

THE TELEPHONE LINE from Salisbury to Berlin is almost completed. As soon as it is in working order the Snow Hill & Wicomico Company will arrange details for connecting the wires for extended operation.

DIRECTORS SELECTED.—The Cairo Telephone Company has completed its organization and incorporated with the following named directors: J. W. Klepinger, V. C. Klepinger, J. E. Roadruck, E. T. Roadruck and Grant Holwerda.

CONTRACT WITH THE NEW TELEPHONE COMPANY.—The Indianapolis board of public safety has awarded the contract to the New Telephone Company for a telephone for the residence of each of the three members, one for the police station and one for the fire department headquarters. The contract is for one year, and amounts to $320.

TELEPHONE SYSTEMS ABSORBED.—A deal was consummated on Dec. 29, which transferred the independent telephone systems of Muncie, Frankfort and South Bend into the hands of the Bell Company, the company being in complete charge Jan. 1. David Allen owned the principal stock in the three independents, and he says the investments were bad at the reduced rates. He charged $13 per year. The citizens anticipate an increase of rates now.

A BIG BOND ISSUE.—The directors of the Logansport, Rochester & Northern Traction Company have authorized a bond issue of $2,500,000, the proceeds to be utilized in the construction and equipment of the proposed electric line from Logansport to Kendallville. President McNary says the bonds have already been negotiated, and that as soon as signed by the officers of the company the money for the construction will be forthcoming, and the work be commenced as soon as weather permits.

A POSSIBLE SALE TO CITY OF ELECTRIC LIGHT PLANT.—The common council of the city of Peru is investigating a proposition made by the Peru Electric Light Company, offering to sell the plant to the city. The plant is a valuable one and is by no means being offered at a sacrifice. Definite action will be taken at the next meeting of the council. The public sentiment favors the purchase and operation by the city.

TELEPHONE EXTENSION.—The directors of the Elkhart Telephone Company have arranged with M. E. Reynolds, principal owner of the Cassopolis Telephone Company, to build a line between Adamsville and French's Landing at Eagle Lake, in order to secure direct connection between the Elkhart and Cassopolis exchanges. This plan will place Elkhart in communication with Benton Harbor, Grand Rapids, and, in fact, many Michigan towns reached by the Central Michigan Telephone Company, which is independent of the Bell Company. The expense of filling the gap will be borne by both the Elkhart and Cassopolis companies.

THE INDIANAPOLIS ELECTRIC CAR WORKS.—The building of new electric street railway cars at Indianapolis by the Indianapolis Street Railway Co. is proving highly satisfactory. The company employs 125 men and completes one car each day. The closed cars now being built are up to date in every particular. Sixty-four new open cars will be built and 30 old ones reconstructed for the company's service. The company has been offered profitable contracts to construct cars for other lines, but Superintendent Grant says the company's demand will be amply supplied first, after which the plant may be enlarged and cars manufactured for the market. Every part of the cars is made here, except the wheels and the motors.

St. Louis, Mo., Jan. 12, 1900.

EXTENDING LONG DISTANCE SERVICE.—The Bell Telephone Company will soon have a line connecting Washington and Pacific, Mo., with St. Louis. Men are now at work

THE MISSOURI ELECTRIC LIGHT & POWER COMPANY re-elected the old officers Jan. 9, except J. C. Van Blarcom, who was made vice-president, and S. B. Pike secretary and treasurer.

THE MISSOURI EDISON ELECTRIC COMPANY.—The old board of directors was re-elected Jan. 9. S. M. Dodd was elected president; James Campbell, vice-president; S. B. Pike, secretary; John G. Kelly, treasurer.

NEW POWER HOUSE.—The directory of the Citizens' Electric Light & Power Company decided at its meeting last week to break ground for its new power house inside of thirty days. The capital of the company was increased to $3,000,000. The company says it has 100 miles of conduit laid, and has cross-arm privileges on the Kinloch poles. Its franchise runs forty-three years yet.

THE WAGNER ELECTRIC COMPANY.—Stockholders of the Wagner Electric Manufacturing Company held their annual meeting Jan. 8, and elected the following officers to serve for the ensuing year: S. M. Dodd, president; James Campbell, vice-president; S. B. Pike, secretary and general manager. W. A. Laman, J. C. Van Blarcom, James W. Bell, Ferd Schwedtmann, H. A. Wagner and S. B. Pike were elected directors.

ELECTRIC AND GAS COMPANY WANTS FRANCHISE.—The attorney for the Ariel Electric & Manufacturing Company has applied for a 50-year franchise to permit the company to lay and maintain pipes and conduits and erect poles and wires for the distribution of gas and electricity, and to lay pneumatic tubes to be operated by compressed air for the distribution of parcels, packages and mail. In consideration for the franchise the company agrees to pay the county 3 per cent. of the net earnings for the first five years, and 3½ per cent. for each year thereafter. It was incorporated about six months ago, with a capital stock of $3000. Charles S. Broadhead, of St. Louis, is president and general manager.

LARGE POWER PLANT PROJECTED.—H. J. Hanford asked for a franchise from the East St. Louis, Ill., City Council, Jan. 8, to lay mains, erect poles and operate a plant for the purpose of manufacturing light, heat and electrical power. He promises to give the city 2 per cent. of the income from all local business. The object of the promoters is the erection of a mammoth plant for the manufacture of electricity for transmission to St. Louis, where it could be furnished at a cost much below the present figures. It will be one of the largest in the country. It could readily furnish power to many of the manufacturing places in St. Louis, and also compete with the local companies for lighting the city. Mr. Hanford is general manager of the Kinloch Telephone Company, Citizens' Electric Lighting & Power Company, St. Louis Electric Construction Company, and Telephone & Telegraph Service Company, of St. Louis.

San Francisco, Cal., Jan. 4, 1900.

TROLLEY CARS IN BAKER CITY, ORE.—The Northwestern Electrical Company has been granted a franchise to operate trolley cars in Baker City, Ore., and also to operate a power and lighting system. Electricity generated by the water power of Eagle Creek will be transmitted to Baker City for the above named uses.

THE GENERAL SUPPLY COMPANY has been incorporated, with a capital stock of $25,000. The principal place of business is San Francisco. The directors are Parry A. Reger, George E. Whittaker and E. Hessler, San Francisco, and M. F. Pixley, of Marin County. Mr. Reger was formerly of the firm of Reger & Atwater, and he is thoroughly acquainted with the electrical supply field. The firm will carry electrical and general supplies.

DIVIDEND.—The Market Street Railway Company, San Francisco, has declared dividend No. 17, of 60 cents per share of the issued capital stock of the company, for the quarter ending Dec. 31, 1899. The company has completed its electric line on Montgomery Street, and is now bonding the rails of the Post Street cable line preparatory to changing over the new route to the money centres of the city. New terminal tracks have been laid at the Ferry Depot.

THE STANDARD UNDERGROUND CABLE COMPANY is now represented on the Pacific coast by Mr. Charles F. Sloane, with offices in the Mills Building, San Francisco. The company is engaged in filling some large contracts with the Independent Electric Light & Power Company. So much business has been contracted for that it has been found expedient to erect works in Oakland, Cal. Machinery, with a large capacity for insulating, has been set up. The works are managed by Superintendent Gribben.

THE MT. WHITNEY POWER COMPANY was recently incorporated, with Visalia, Cal., as the principal place of business. Directors: W. H. Hammond, A. G. Wischon, R. P. Hammond, Benjamin H. Maddox and Susean Mitchell, of Visalia. Capital stock, $300,000; subscribed, $225,000. The company has a long distance electric transmission system in successful operation. The water power of the Kaweah River is utilized, the generating station being located about 35 miles from Visalia. There are three 450-kw, three-phase Westinghouse generators, direct connected to water wheels. The distance of transmission to Porterville is 43 miles and to Tulare, 40 miles. The Visalia substation is equipped with a motor which drives an arc machine for street lighting.

TELEPHONE LICENSE ORDER VETOED.—Mayor Phelan, of San Francisco, has vetoed the order imposing a quarterly license fee of one dollar for every telephone box having a nickel-in-the-slot machine attachment. City Attorney Lane, when asked for his opinion before the order was passed by the board of supervisors, advised the board that it would not stand in the courts. The conclusions of the attorney were that the order would be legal if it did not interfere with the interstate traffic of the corporations affected, and if it applied alike to all telephones, but he held that the board had no right to discriminate between nickel-in-the-slot telephones and those without such attachments. The mayor's veto is based entirely upon the above opinion, as he would avoid fruitless litigation. There are nearly 12,000 telephones in San Francisco that would be affected by the enforcement of the order which would bring the city an increased revenue of about $45,000 per annum. The order also provided that the telephone company must give the switch before demanding the depositing of a nickel, and fixed a penalty of $300 for non-compliance therewith.

THE CONSOLIDATED LIGHT & POWER COMPANY has been incorporated, for the purpose of manufacturing gas, electric currents and electric energy for light, heat and traction work in all the municipalities and counties in state of California. The directors and subscribers are Robert J. Davis, of Ross, Marin County; E. M. Pease, Palo Alto; C. E. Green, San Mateo; A. Poniatowski and J. E. Green, San Francisco. The capital stock is $500,000, of which $50 has been subscribed. Nearly all of the directors have been connected with the San Francisco Gas & Electric Company, and are now associated with the interests of Prince Poniatowski, of the Standard Electric, and other California companies.

SOUTHERN NOTES.

Austin, Texas, Jan. 11, 1900.

ELECTRIC LIGHT AT CENTER POINT, TEXAS.—A company has been organized and work will soon begin on the establishment of an electric light plant at Center Point, Texas.

NEW POWER PLANT.—The Austin Dam & Suburban Street Railway Company is preparing plans and specifications for a new steam power plant. Heretofore this company has been obtaining its power from the city's electric power plant.

TAXATION OF TELEPHONE AND TELEGRAPH COMPANIES.—A recent meeting of the interstate attorney and state attorneys of the Southwestern Telegraph & Telephone Company was held in Austin for the purpose of deciding on some plan of action to be followed at the coming session of the state legislature, which proposes to pass a tax bill assessing a tax of 2 per cent. on the gross earnings of all telegraph and telephone companies doing business in Texas. At this meeting of attorneys it was decided to oppose the passage of the proposed bill.

THE WATER AND LIGHT BOND MATTER.—Representatives of the eastern holders of the Austin water and light bonds are here investigating the financial condition of the city and compiling data to be used in the preparation of suits to be filed by the bondholders in the federal court for the recovery of the defaulted interest and principal due them on the bonds. The action of the city council in seeking to repudiate this bonded indebtedness of $1,500,000 is being severely criticised by the majority of taxpayers of this city. The project of installing an auxiliary steam plant at the electric light and power station here has been abandoned on account of the critical condition of affairs which now confronts the city.

THE TEXAS TAX LAW.—The state legislature has been called to meet in special session on Jan. 23, for the purpose of revising the state tax laws. The state tax commisssion has formulated a bill which will be submitted to the legislature for approval and passage, which embraces some far-reaching reforms in the existing tax laws. Among other things it proposes to tax all telephone and telegraph companies doing business in Texas 2 per cent. of their gross receipts on business in this state. It is claimed by officials of the interests sought to be affected that a tax of 2 per cent. on gross earnings would mean a tax of not less than 12 per cent. on the net earnings, and that it would drive them out of the state. In addition to taxing telegraph and telephone companies 2 per cent. on their gross earnings the proposed bill also levies a heavy tax on street car, gas, electric light and water companies.

Memphis, Tenn., Jan. 12, 1900.

THE TENNESSEE BREWING COMPANY, of this city, is now putting in a large electric light plant for its immense buildings. Siemens & Halske machines will be used.

J. A. BAILEY & CO., the largest plumbing firm in the city, have given up the electrical wiring business entirely and are now doing a jobbing trade in electrical goods of every description.

MR. C. W. BOLTON, of Pontotoc, Miss., is rebuilding the lines of the Alabama, Mississippi & Tennessee Telephone Company between Middleton, Tenn., and Pontotoc, Miss., and installing bridging bells in place of series instruments. This company will soon have a telephone line completed between Pontotoc and Oxford, Miss.

GOV. McLAURINS AGAINST COMBINATIONS.—In his message to the Mississippi Legislature, Governor A. J. McLaurins refers to trusts and combines in the following language: "As trusts and combines are detrimental because they eliminate natural and legitimate competition, so any form of destruction of such competition is equally hurtful. Rich and powerful telephone companies or systems crush out competition by reduction of the rate below a living minimum price, where there is a competing company, until they drive their competitor out of business, and they then restore the tariff to its former rate. I recommend that you enact a law prohibiting any telephone company or system from raising its tariff rates higher, after any of its competing lines or companies has suspended, than its minimum rate during the operation or existence of such competing line or company."

CANADIAN NOTES.

Ottawa, Ont., Jan. 13, 1900.

THE YUKON TELEGRAPH LINE.—The returns at the interior department at Ottawa show that the receipts for the first two months that the Yukon telegraph line was in operation amounted to over $13,000.

MUNICIPAL LIGHT IN HULL. The city engineer of Hull, Ont., is at present engaged in preparing plans for the new dynamo house to be erected. and it is likely the new electric lighting system for that city will be installed and in operation by August next. The plans call for 75 arc lights. About six miles of streets will be lighted. Power will be secured from two 50-light dynamos.

THE BELL TELEPHONE COMPANY has just completed and opened for business a new heavy long distance copper metallic circuit line between Ottawa, Carleton Place, Smith's Falls and Brockville, in the province of Ontario. The completion of the line required upward of 3500 poles, 4000 cross-arms and 75,000 lbs. of copper wire. This line gives Ottawa a direct long distance service with Buffalo, N. Y., and other western points, and a material reduction has been made in the rates to these places. Formerly business had to be carried on via Montreal to reach them. Ottawa has now direct connection with Utica, Watertown, Ogdensburg and other central New York points by telephone.

MUNICIPAL LIGHT VOTED IN OTTAWA.—The capital of the Dominion has voted to own and operate an electric lighting plant. The majority of nearly 1000, by which the rate payers of Ottawa voted on the first of January in favor of municipal ownership, was an interesting sign of the times. Other similar signs, occurring on the same day in the province of Ontario alone, were at Woodstock, where the electors, by a majority of 621, voted to establish a civic electric light plant; at Pembroke, where a majority of over 200 was recorded in favor of a similar move; and at Lindsay, where by an overwhelming majority, it was decided to purchase the water works system, at present owned and operated by a private corporation. All these votes are taken to be indicative of the general trend of public opinion throughout the principal cities and towns of Ontario in favor of municipal ownership and control.

ENGLISH NOTES.

London Office, Electrical World and Engineer, Jan. 1, 1900.

WELSBACHS.—It is interesting to note that the Welsbach patent, the original patent granted to Dr. Auer von Welsbach for incandescent mantles for gas lighting, expired on the 12th of December.

INSTITUTION BRANCHES.—At the ordinary general meeting of the Institution of Electrical Engineers, Prof. S. P. Thompson, president, stated that the council had been promoting the organization of local centres both within and without the United Kingdom, and had decided to recognize them through the institution. Such local organizations have been instituted at Newcastle, Glasgow and Dublin, and one has also been formed and acknowledged at Cape Town.

GLASGOW WORK.—It has now been definitely settled that the estimate of the National Conduit & Cable Company, of New York, be recommended for acceptance by the Glasgow Corporation Tramways Committee. The estimate, which was £151,000, is for laying underground feeders in the streets in Glasgow not already equipped. There has been a battle royal over this order, much comment having arisen on account of this work being given to an American company while there are a number of English companies well able to do this class of work.

THE INSTITUTION OF ELECTRICAL ENGINEERS has recently had read before it some very interesting papers on the consumption of coal and cheap fuels, in which much valuable information has come out in the comparisons of Lancashire boilers with water-tube boilers. The Institution is to be congratulated on the presentation of these papers, as electrical engineers are apt to pay too much attention to the electrical side of the problem, leaving the less interesting, perhaps, but equally important, mechanical side untouched or at least insufficiently discussed in public meetings.

A THOUSAND-MILE RUN.—A meeting was recently held in Edinburgh under the auspices of the Scottish Automobile Club, for the purpose of discussing the proposed 1000-mile trial during April and May next from London to Edinburgh and back. The trial would be under the auspices of the Automobile Club of Great Britain and Ireland, and would be more a test of reliability than of speed and would, therefore, be in no sense a race. It is intended to hold exhibitions in each city visited en route, such as Bristol, Birmingham and Manchester, each city undertaking its own arrangements and guaranteeing a fund necessary to meet the expense, the profits, if any, to go to the war funds.

OVERLOADED STATIONS.—Now that we are right in the middle of the season of shortest daylight, and, consequently, the season of greatest demand for artificial light, it appears almost ludicrous to note that one of the chief electricity works in London is beseeching its customers to use as little current as possible between the hours of 4 and 6 p. m. In other words, it is a complete confession of weakness, and from comments which we hear on all sides and the numerous complaints we notice, this condition appears to be true of most of the electricity supply companies in London. In a word, they are overloaded. Some of the stations are even obsolete, and ought to be completely remodeled, and much greater capacity arranged for. It is comforting to note, however, that some of the most important companies have realized the condition of affairs, and are erecting modern plants outside the city with high-tension transmission to substations in the city and surrounding districts.

REFUSE DESTRUCTORS.—Mr. C. Newton Russell's paper on "Combined Refuse Destructors and Power Plants," read recently at the meeting of the Civil Engineers, gave many valuable details as to how excellent results were attained by the burning of ordinary domestic refuse for fuel in raising steam to supply the necessary energy for the operation of supplying electricity. The Shoreditch plant was described in particular, and a few details will be found interesting. From 80 to 100 tons of refuse are received and burned daily, in special furnaces, applied to Babcock & Wilcox boilers, forced draught being used, and a temperature of 1500 to 2500 degrees Fahrenheit being attained, without using a pound of coal. The clinker residue amounts to 32 per cent., and when mixed with cement makes excellent paving slabs. The average cost of burning the refuse was about 50 cents per ton, and the total amount of electrical energy sold by meter to customers was 1,031,348 Board of Trade units, which would go to show that this was a most economic way of disposing of refuse of this nature.

COMMERCIAL WIRELESS TELEGRAPHY.—It is interesting to note that the Marconi system of wireless telegraphy is making steady progress in this country, and actual business is now being transacted by the Wireless Telegraph & Signal Company. They have just completed arrangements with the Southeastern Railway Company and the London, Chatham & Dover Railway Company, by which both of these companies will use the Marconi system on their steamers running between Dover and Calais, and Folkestone and Boulogne. Though the above companies are competing lines, they have gone into this matter together, and only one pole erected at Dover will command the two fleets either in crossing the Channel or in port on the other side. Owing to the short distance across the Channel, the ships' masts will be sufficiently high to act as receiving poles, both in crossing and in port. It will be possible for communication to be held with the Ostend boats also if the Belgian government desire it, but, in that case, a pole would have to be erected at Ostend.

General News.

THE TELEGRAPH AND TELEPHONE.

BRISTOL, PA.—The Standard Telephone Company is extending its line from Newtown to Bristol.

MORAVIA, IA.—The Moravia Telephone Company has in contemplation the building of about 250 miles of toll lines.

PHILADELPHIA, PA.—The new telephone line between West Chester and Malvern has been thrown open to the public.

HARRISBURG, PA.—The Slate Belt Telephone Company is extending its lines through Lehigh, Northampton, Carbon and Schuylkill counties.

COLUMBUS, O.—The American District Telegraph Company has sold out to a company which is acquiring District Telegraph property in several cities.

BRISTOL, TENN.—The East Tennessee Telephone Company will thoroughly overhaul and improve its exchange here and advance rates 100 to 200 per cent.

TOPEKA, KAN.—The Missouri Telephone Company will set 1000 miles of poles and string 10,000 miles of wire at once, covering territory in Missouri, Kansas and Oklahoma.

LEXINGTON, S. C.—The Lexington Telephone Company has been incorporated. Capital, $5000. Incorporators, A. Jones, of Columbia; W. P. Roof, J. Bradley, both of Lexington.

ROLFE, IOWA.—The Rolfe Telephone Company has been incorporated. Capital, $10,000. Incorporators, W. Ferguson, M. Graham, C. E. Fraser, S. H. Karr, W. P. Wheeler, A. M. White, F. King, C. A. Grant, E. R. Ames, all of Rolfe.

PHILADELPHIA, PA.—An ordinance was introduced in the council to revoke the rights granted in this city to the Drawbaugh Telephone Company saying it shows no disposition to enter into competition with the Bell Telephone Company.

BOSTON, MASS.—The Pacific Coast Telephone companies made a net gain of 2218 subscribers in December, and had in operation Dec. 31, 64,538; net gain for the year 19,553, or over 43 per cent. San Francisco has in operation 16,817 sunscribers.

MORRISTOWN, TENN.—The stockholders of the Independent Telephone Company decided to petition Judge Clark, of the federal court, to order a sale of the property on Jan. 30. It is stated that the East Tennessee Company will buy the exchange.

BINGHAMTON, N. Y.—The New York & Pennsylvania Telephone & Telegraph Company will, in the spring, install the common battery system in this city. A multiple switchboard will be placed in the exchange. There are 1000 subscribers in this city.

SIOUX CITY, IA.—The Home Telephone Company, a local corporation, has been absorbed by the Iowa Telephone Company, and henceforth Sioux City will have only one telephone exchange. The transfer will include the Sioux City exchange and also the toll lines in Iowa and South Dakota.

HUNTSVILLE, ALA.—Two hundred and seventy subscribers have been secured by the Independent Telephone Company for its proposed exchange in this city. Every village in Madison County will be connected by telephone with the city and telephones will be placed in many farm houses and stores.

SOUTH BEND, IND.—The Citizens' Telephone Company has gone out of existence after a four years' struggle at a heavy loss on account of making rates too low. At the start the Grocerymen and Butchers' Association gave support to the new company and now it announces that it will sue the Citizens' Company on a contract to give service at low rates. The subscribers contracted for five years' service, and base the claim on unfulfilment of contract.

ELECTRIC LIGHT AND POWER.

MORAVIA, IA.—There is an opening here for an electric light plant.

IRON RIVER, MICH.—Iron River residents will vote on the proposition to bond the town for $6000 to put in an electric lighting plant.

JAMAICA, L. I.—Sheriff Baker has attached the property of the Jamaica Electric Light Company to satisfy an execution for $2200 obtained by Wyckoff Van Siclen.

CRISFIELD, MD.—The Standard Telephone Company, which built a toll line to Marion last winter, is about to extend its line to Princess Anne, the county seat.

BUFFALO, N. Y.—The extensive malleable iron and steel works of the Pratt & Letchworth Company on Tonawanda Street, is now run by electricity, generated at Niagara Falls.

GALLIPOLIS, O.—The Gallipolis electric light plant, operated by Messrs. Chas. A. and J. Will Clendinen, went into the hands of a receiver. Attorney Earl Mauck was made the receiver.

BINGHAMTON, N. Y.—The Binghamton General Electric Company, Binghamton, N. Y., has declared a semi-annual dividend of 2 per cent. This company is owned in Boston.

ENCAMPMENT, WYO.—The Emerson Electric Light Company, of Encampment has been incorporated. Capital $60,000. Incorporators, W. G. Emerson, B. McCaffrey, W. R. Thompson, all of Denver, Col.

WASHINGTON, IND.—The owner of the electric light plant at Washington is willing to sell the plant to the city for $67,000, with $10,000 added for value of the franchise, having three years still to run.

WATERFORD, ME.—The Waterford electric light and power plant, which was installed by W. R. Irwin a year ago last summer and operated by him until burned out last August, has been purchased by Mr. Clinton Bolard.

CHARLESTON, S. C.—Alabama Electric Light & Power Company has been incorporated in Opelika, Ala. Capital, $50,000. Incorporators, H. S. Parsons, T. S. Parsons, H. C. Davidson, J. W. Parsons, J. S. Pou, all of Montgomery, Ala.

NEW HAVEN, CONN.—The New Haven Electric Company and the Bridgeport Electric Company have been absorbed by the new corporation, the New Haven Illuminating Company. The latter will issue $1,000,000 in stock to cover purchase.

LEWISTON, MO.—The city lights were turned on at this place Dec. 30. The city has only 500 people and it claims the distinction of being the smallest city in the State that is lighted by electricity. There are 275 lights now and the number will be increased to 350.

THE ELECTRIC RAILWAY.

HARTFORD, CONN.—A plant for the storage of electricity for the third-rail system is to be erected at Bristol by the Consolidated road.

HOLLAND, MICH.—The car barn and all the cars, 11 in number, and the freight motor of the Holland & Lake Michigan Electric Railway Company were destroyed by fire on the night of Jan. 11. The loss is estimated at $40,000. The power house was saved.

DOYLESTOWN, PA.—William Jenks Fell, promoter of the Doylestown & Willow Grove trolley road, is the leading spirit in the Doylestown Railway Company, which has put on record plans for trolleys to enter nearly every little town in Bucks County.

GREENSBURG, PA.—The car barns of the Greensburg, Jeannette & Pittsburg Electric Railway were burned, and all rolling stock, embracing eight cars, destroyed. The prospects are that the road will be abandoned. Loss $60,000. The owners are capitalists of Harrisburg.

JOLIET, ILL.—The Joliet Railway Company has been granted two twenty-year franchises, one for an electric line from Joliet to Manhattan, a distance of eleven miles, and one for a line from Joliet to Plainfield, a distance of nine miles. Officers of the company say the two suburban lines will be built this spring. The company is also preparing to push work on its line from Lockport to Chicago.

SPRINGFIELD, ILL.—A westbound street car on the Monroe Street line was blown up with dynamite on the night of Jan. 4 and completely wrecked. There were 14 passengers on board, all of whom were badly shaken up and frightened, but not otherwise injured. A stick of dynamite had been laid across the rail. This is the fourth time since the strike and boycott was declared against the Springfield Consolidated Railway Company early in November that dynamite has been used against the cars.

WORCESTER, MASS.—The Worcester & Suburban Street Railway Company plans to concentrate all its power plants, car houses, machine and repair shops in Worcester. The directors of the company have been contemplating the move for some time and at their meeting in January it is expected will formally adopt the plans and specifications as prepared. Work will begin as early in the spring as the weather will permit. By August 1 the present power plants, car houses and buildings in Leicester and Millbury will be abandoned and Worcester will be made the headquarters for the rolling stock of the company.

ALBANY, N. Y.—The certificate of consolidation of the Albany Railway, Troy City Railway Company and Watervliet Turnpike & Railroad Company, to be known hereafter as the United Traction Company, was filed with the secretary of state. The capital stock of the new company amounts to $4,000,000, and the principal office will be in Albany. The directors are Robert C. Pruyn, Anthony N. Brady, John G. Myers, A. Bleecker Banks, John W. McNamara, James H. Manning, former Attorney General Simon W. Rosendale, William J. Walker, of Albany; former United States Senator Edward Murphy, Jr.; Charles Cleminshaw, William Kemp, Francis N. Mann, Jr.; James O'Neil, William Shaw and Superintendent of State Prisons C. V. Collins, of Troy. The officers are: President, Robert C. Pruyn; vice-president, Charles Cleminshaw, and treasurer, John W. McNamara.

THE AUTOMOBILE.

THE WASHINGTON ELECTRIC VEHICLE COMPANY, incorporated in Trenton, N. J., last May, has filed papers decreasing its capital stock from $6,000,000 to $1,125,000.

BOSTON, MASS.—At a meeting of the Board of Directors of the New England Electric Vehicle Transportation Company, Col. Albert A. Pope was chosen a director to take the place of Mr. Abner J. Tower, who resigned on account of illness.

NEW HAVEN, CONN.—A new corporation, known as the Kidder Motor Vehicle Company, formed by New Haven men, was incorporated in Dover, Del., on Jan. 10, with a capital stock of $500,000. The company will manufacture here, and it is understood will make electric vehicles.

MEXICO.—The Mexican Electric Vehicle Company has been formed, with a capital of $500,000, to manufacture and operate vehicles, especially in Mexico. Incorporators: J. E. Hayes, Camden; Arthur Philips, New York; Fred Viewig, Upper Montclair, N. J. All these gentlemen are connected with the Electric Vehicle Company of New York.

BOSTON BUSSES.—By the Boston Transit Company's recent election it appears that this new automobile company, which is the same to which locations for electric omnibus lines from the Back Bay to downtown districts were granted recently by the board of aldermen, has been completely reorganized since it first appeared before the public a year ago. It is a branch of the New England Electric Vehicle Transportation Company, and Mr. T. K. Cummins, Jr., is secretary and treasurer of both. It has a capital stock of $100,000.

NEW COMPANIES.

THE AMERICAN ELECTRIC APPLIANCE COMPANY, of Philadelphia, has been incorporated to manufacture electrical devices. Capital $100,000.

THE HOMER COMMUTATOR COMPANY, of Cleveland, O., has been incorporated to manufacture and sell electrical machinery. Capital $25.000. Incorporators, F. L. Homer, L. Hohlfelder, Jr., B. H. Husbands, F. B. Krause, A. W. Massey.

THE AMERICAN TELEPHONE REPEATER & QUAD COMPANY has been incorporated, to manufacture improved telephone apparatus. Capital, $200,000. Incorporators, Louis E. Watkins, William H. Chapin, Francke W. Dickinson, and Frederick S. Newman, of Springfield, Mass., and George M. Butterick, of Everett, Mass.

EDUCATIONAL.

LECTURES IN NEW YORK.—Very valuable lectures on scientific topics of especial interest to artisans are being given in the New York Board of Education Course of Free Lectures at the following places: At St. Bartholomew's Lyceum Hall, 205 East Forty-second Street, Prof. E. R. Von Nardroff will give a course of very fine lectures on "Heat as a Mode of Motion" on successive Saturday evenings; the same course is being given on Wednesday evenings at the Y. M. C. A. Hall, 52 East Twenty-third Street. All of these lectures will be illustrated by experiments and stereopticon views. At Public School 15, 728 East Fifth Street, a valuable course on physics, illustrated by many experiments, is given by Mr. J. Newton Gray, on successive Thursdays. A course of two lectures on "Sound," illustrated by the phonograph and telephone, will be given by Mr. Th. I. Jones, at Public School 5, 141st Street and Edgecombe Avenue, on Jan. 22 and 29; these lectures will also be given at Public School 64, 2436 Webster Avenue, Fordham, on Jan. 25 and Feb. 1, and at Public School 61, Third Avenue, between 169th and 170th streets, on Jan. 26 and Feb. 2. A lecture, illustrated by experiments and stereopticon views, was given by Mr. W. W. Ker, on "Electricity in Our Homes," at Public School 64 (Fordham) on Jan. 11; at Public School (61 Third Avenue, between 169th and 170th streets) on Jan. 12, and at Public School 5 (141st Street and Edgecombe Avenue) on Jan. 15. Mr. F. M. Pedersen will lecture on "Wireless Telegraphy," at Public School 64 (Fordham) on Jan. 18; Public School 61 (Third Avenue, between 169th and 170th streets) on Jan. 19, and at Public School 29 (Albany and Carlisle streets) on Feb. 15. A lecture on "The Horseless City, or the Age of the Automobile" will be delivered by Mr. Max Lowenthal at Public School 5 on Feb. 5, and at Public School 64 on Feb. 8. Mr. W. J. Clarke will lecture on "The Wonders of Modern Science;" at Public School 61 on Feb. 9, and at Public School 64 on Feb. 15. Mr. F. W. Skinner will deliver a lecture on "Bridges" at Public School 5 on Feb. 12, and at Public School 64 on Feb. 22. These lectures begin promptly at 8 p. m. All interested are welcome.

PERSONAL.

MR. C. P. GEDDES, treasurer of the Sprague Electric Company, has been elected by a large unanimous vote one of the governors of the New York Athletic Club, of which he has long been a well-known member. There is a large electrical and enginering contingent in the organization.

MR. A. E. WINCHESTER, the energetic superintendent of the municipal electric light plant of South Norwalk, Conn., while offered recently large inducements to enter the service of a leading private company, has decided to remain with the plant at least another year, to develop it still further.

CAPT. SAMUEL REBER, U. S. A., was married on Jan. 10, at Washington, to Miss Cecilia Miles, daughter of General Miles, U. S. A. The ceremony was witnessed at St. John's Church by the leaders of the social life of the National Capital, including the British, German, Belgian and Russian Ambassadors and families, Secretary John Hay, etc. Among the ushers was Capt. G. O. Squier, U. S. Signal Service. The happy pair have left on a wedding trip South. Capt. Reber, who is stationed at Governor's Island, N. Y., is widely known in electrical circles.

LEGAL.

TAX DECISION.—A tax case was decided on Jan. 9 by the Court of Appeals at Albany, which has an important bearing on electrical interests in this state. Assessor of Kingston in 1898 assessed the personal property of the Cornell Steamboat Company of Kingston at $250,000. The company contended that a comparison of its assets and indebtedness showed a deficiency of $54,748. A 6 per cent. dividend was being paid annually by the company upon its capital stock. It was contended on behalf of the assessing officer that a corporation paying 6 per cent. upon its capital stock was not entitled to any deduction for debts existing against its personal property. Had the Court of Appeals sustained the decision of the assessing officer there would have been an enormous increase in the assessable value of the corporate properties held in this state by railroad, gas, water, electric light and other similar corporations.

DAMAGES FROM JAR, SMOKE AND CINDERS.—Justice Truax, in the New York Supreme Court, Special Term, has granted judgment in favor of Sarah A. Bly in her suit against the Edison Electric Company, restraining it from conducting its business at its power house, in 26th Street, in such a manner as to constitute a nuisance, and the plaintiff is awarded $5000 damages. Justice Truax says the evidence showed that smoke and cinders were emitted from the company's premises, great quantities of which fell upon Mrs. Bly's boarding house; that the jar and vibration caused by the running of the company's machinery were to such an extent and degree as to interfere seriously with her enjoyment of her premises; that she was prevented from renting rooms in her house, and that her furniture and household effects were injured, and extra expense for laundry work also resulted.

Trade and Industrial Notes.

REMOVAL.—The Sterling Varnish Company announce their removal from 325 Water Street, Pittsburg, Pa., to the Times Building, Fourth Avenue, same city.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is sending out pamphlets describing the Adams-Bagnall enclosed arc lamp. Copies can be had on application.

CALENDARS.—During the past week we have received calendars for 1900 from the following-named concerns: Walsh, Sons & Co., dealers in scrap iron and metals, 260 Washington Street, Newark, N. J.; Alfred F. Moore, wires, etc., Philadelphia, and the Morgan Gardner Electric Company, 2638 Shields Avenue, Chicago, Ill.

THE NOWOTNY ELECTRIC COMPANY.—The Ezekiel & Bernheim Company, auctioneers, Cincinnati, Ohio, has issued a catalogue of the stock of the Nowotny Electric Company, which was advertised for sale at auction on Jan. 10. The list includes the company's electric lamp and dynamo manufacturing machinery, lamps, appliances, etc., together with the good will of the business.

THE TAYLOR SLEEVE GATE TURBINE, manufactured by John W. Taylor, 818½ Main Street, Lynchburg, Va., is built in 23 sizes, both right and left hand, and the style of settings embraces over 100 different plants. Much attention has been given to the production of a high-class, efficient turbine wheel with easy working gates. Mr. Taylor is employing the best engineering talent in his work, and solicits correspondence from those desiring modern, up-to-date turbine wheels and power connections.

THE C & C ELECTRIC COMPANY, New York, are ready to receive orders for their new line of four-pole slow-speed dynamos and motors, to be known as their type "F. P." machines. The line ranges from 5 to 45-hp, and the machines are designed for use in any position. They are furnished in either the entirely open or entirely enclosed types. In either type ready access may be had to the commutator and brushes. The C & C Electric Company will be pleased to send to all interested a copy of their descriptive bulletin No. 132.

INDUSTRIES IN THE SOUTH.—The twenty-first annual number of *The Tradesman* is replete with practical and valuable articles on topics of supreme interest to the South from writers who are thoroughly posted on the subjects of which they treat. Among the special features of the number may be noted articles on the "Iron Interests of the South," an elaborate illustrated review of the "Electrical Development of the South," embracing an account of the new sewerage system at New Orleans, which was fully described and illustrated in these columns in the issue of Nov. 18, 1899. The textile interests of the South are also carefully treated. Interesting contributions are presented on "Technical Education," and a well-illustrated article is given on the "Steel Manufacturing and Mining Interests of the Birmingham District," showing the new steel mill, wire rod mill, etc.

THE JEWELL ELECTRICAL INSTRUMENT COMPANY, of Chicago, until the last few months, was engaged in the manufacture and sale of portable and laboratory instruments only. It is now, however, making switchboard direct current instruments. The business of the company has increased to such an extent during the past six months that larger factory space became imperative. This the company has secured on the corner of Randolph and Canal Streets, and the new quarters will be taken possession of on Feb. 1. The company will then have factory capacity quadruple that of the present. A descriptive price list of the Jewell instruments has just been issued. The list covers portable ammeters, milliammeters, voltmeters, millivoltmeters and switchboard ammeters and voltmeters. These instruments have been before the trade for two years, and, it is said, give the best of satisfaction.

AN INGENIOUS ARRANGEMENT to prevent overcrowding of stairways and elevators when entering or leaving a building is used in the main office of the International Correspondence Schools, Scranton, Pa. The time of entering and leaving the building is regulated by clocks on each of the five floors. On the lower floors the clocks are set correctly, but on the upper floors they are a few minutes slow, so that the employees on the lower floors are at their desks before those on the upper floors are due at the building. In leaving the building the employees on the upper floors do not leave their desks until several minutes later than those on the lower floors. Over 500 people are employed in the building, which is used exclusively by The International Correspondence Schools. This institution has over 70 courses of instruction by mail, and its students may be found in all parts of the world.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JAN. 9, 1900.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

640,744. LIGHTNING ARRESTER; C. C. Chinn, Canton, Mo. App. filed July 21, 1899. The ground plate stands between two discharge plates which are connected together by a fuse.

640,747. ELECTRIC MOTOR; O. F. Conklin, Springfield, Ohio. App. filed April 24, 1899. The pole pieces which are integrally connected with a ring-shaped yoke which has horns projecting in one direction only. The coil slips into place by being turned sidewise and passes over the wiring.

640,748. ELECTRIC MOTOR AND CIRCUIT THEREFOR; O. F. Conklin.

Springfield, Ill. App. filed April 24, 1899. Small motors are connected in series, the field magnets being always in circuit and resistances being provided which are automatically thrown in to take the place of the armature when in one or more motors are cut out.

640,749. CONTROLLER OPERATING MECHANISM; W. H. Conrad, New York. App. filed Nov. 1, 1899. By this device the operator is enabled to move the controller handle from point to point where it is locked until the speed of the car has been accelerated sufficiently to correspond with the speed indicated by the point, when the handle is automatically released to permit of another movement.

640,753. DEVICE FOR INDICATING CONDITION OF STORAGE BATTERIES; H. P. Cuntz, Hartford, Conn. App. filed Oct. 27, 1899. (See Current News and Notes.)

640,758. FLEXIBLE METALLIC CONDUIT; E. T. Greenfield, New York. App. filed July 17, 1899. The jagged ends formed by cutting off an armored conduit are covered by a bushing or end cap to prevent laceration of the wires.

640,760. INDUCTOR DYNAMO ELECTRIC MACHINE; H. Geisenhoner, Schenectady, N. Y. App. filed Nov. 14, 1898. (See Current News and Notes.)

640,771. MEANS AND APPARATUS FOR REMOVING WOOL OR OTHER HAIR FROM SKINS; S. L. and E. Johnson and A. H. Gibbings, Bradford, England. App. filed May 31, 1899. An electric wire adapted to be brought to incandescence is stretched along the front edge of the tool for the purpose of burning off the hairs.

640,787. DEVICE FOR INDICATING CONDITION OF STORAGE BATTERIES; H. P. Maxim, Hartford, Conn. App. filed Oct. 27, 1899. (See Current News and Notes.)

640,810. TROLLEY WHEEL; G. F. Raum, Jr., New York. App. filed Oct. 5, 1898. Structural details directed toward cheapness of manufacture and general efficiency.

641,012. BRUSH FOR DYNAMO ELECTRIC MACHINES; G. Heidel, St. Louis, Mo. App. filed March 27, 1899. The connecting brush is made of aluminum.

641,051. ELECTRICAL MEASURING INSTRUMENTS; J. S. Stevens, Philadelphia. App. filed Oct. 4, 1899. The instrument comprises a fixed coil, a movable coil adapted to oscillate, a spiral spring connecting two movable coils and a pendulum spring also connected with the movable coil, and adapted to vibrate under tension from one side to the other from its position of equilibrium and to counteract the tension of the spiral spring during the first part of its movement and to reinforce the same during the latter part of its movement.

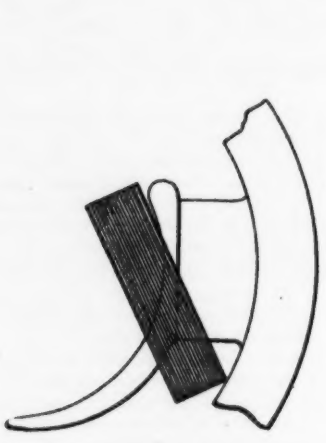
641,079. COMBINED RHEOSTAT AND ATTACHMENT PLUG; L. D. Carter, Louisville, Ky. App. filed Oct. 20, 1899. This invention provides a fixed resistance conductor, suitably encased within an attaching plug for the purpose of reducing the energy to translating devices, necessitating a potential lower than that of the supply circuit.

641,117. STOPPING DEVICE FOR ENGINES; J. J. Kaye, Newburg, N. Y. App. filed Aug. 25, 1899. By means of circuits extending to various localities, and circuit closers at these localities, a valve controlling lever is released, permitting a spring to shut off steam.

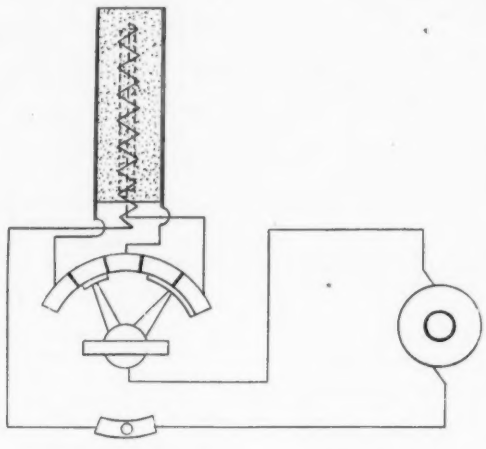
641,125. ELECTRIC MOTOR; H. Leitner, London, England. App. filed May 16, 1899. Details of construction.

641,140. ELECTRICITY METER; C. E. O'Keenan, of Paris, France. App. filed June 2, 1898. In connection with a strong, permanent magnet is a movable armature, consisting of a number of coils of wire rotably mounted in the field of the magnet; this armature giving no motion to, nor containing in its structure any movable part which can produce a damping effect upon the armature.

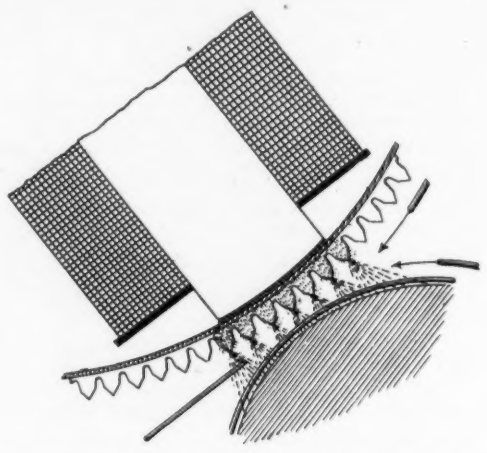
641,147. APPARATUS FOR MAGNETICALLY SEPARATING ORES; C. Q. Payne, Stamford, Conn. App. filed June 26, 1897. The improvements consist of means for controlling the circuit of the magnetic flux generated by an electromagnet, so as to establish a single magnetic field upon them, within which certain other improvements may be conveniently employed.



640,747.—Electric Motor.



641,196.—Electric Lamp.



641,220.—Apparatus for Magnetically Separating Ores.

640,823. TELEPHONE; R. F. Smith, Chicago, Ill. App. filed Feb. 16, 1899. (See Current News and Notes.)

640,872. FIRE ALARM SIGNALING APPARATUS; L. Campbell, Washington, D. C. App. filed March 17, 1899. The box is provided with an apparatus whereby a person sending in the alarm will be detained at the box for a few minutes, and whereby a local alarm will also be given, notifying persons in the vicinity that some one is at the box.

640,873. FIRE ALARM SIGNALING APPARATUS; L. Campbell, Washington, D. C. App. filed Sept. 26, 1899. The box has a door through which access is obtained to the signaling mechanism; also a supplemental door through which access is obtained to the fastening devices of the first door; also an electric alarm adapted to be sounded when the supplemental door is opened.

640,959. SECTION INSULATOR; J. S. Schumaker and L. M. Glodell, Hartford, Conn. App. filed June 14, 1899. The insulator comprises a case having an opening extending therethrough from end to end, and two oppositely disposed end members embodying coacting wedges supported in such case.

640,968. ELECTRIC VEHICLE; E. A. Sperry, Cleveland, Ohio. App. filed Aug. 19, 1898. (See Current News and Notes.)

640,988. TELEPHONE SYSTEM; J. R. Blinck and C. H. West, Jersey City, N. J. App. filed May 8, 1899. (See Current News and Notes.)

641,005. TELEPHONY; S. B. Fowler, Tarrytown, N. Y. App. filed Jan. 7, 1899. (See Current News and Notes.)

641,011. BATTERY; Gustavos Heidel, of St. Louis, Mo. App. filed Feb. 4, 1899. Relates to sealing primary batteries and a peculiar construction of vent valve. The seal of the cell is composed of a lower layer of material that will float readily, such as comminuted cork. On this is placed an intermediate layer of waxy substance, such as paraffin, and surmounting the latter is an upper layer of plaster of paris. A vent is provided which permits the escape of any gas formed in the battery, and is composed of a tube, within which is a stem provided with a button on its lower end adapted to move and seat against the inner end of the tube should the battery be upset or inverted. In the wall of the battery is a transparent sight plate through which the contents may be observed without removing the seal.

641,148. METHOD OF MAGNETICALLY SEPARATING ORES; C. Q. Payne, New York, N. Y. App. filed Jan. 20, 1897. The method consists in introducing the mixture into a magnetic field of undulating magnetic potential, formed in the air gap of a magnetic circuit; attracting to one side of said field the more magnetic particles; conveying the separated groups of particles along vertically diverging lines out of the field, and discharging them in different paths of movement.

641,157. SWITCH FOR ELECTRIC MOTORS; O. F. Shepard, Jr., Madeira, Ohio. App. filed May 19, 1899. With this switch, when the connection is made with the source of supply, the field and armature of the motor are both in circuit with the source and when the switch is operated to cut off the source, a closed circuit is maintained which always includes the field.

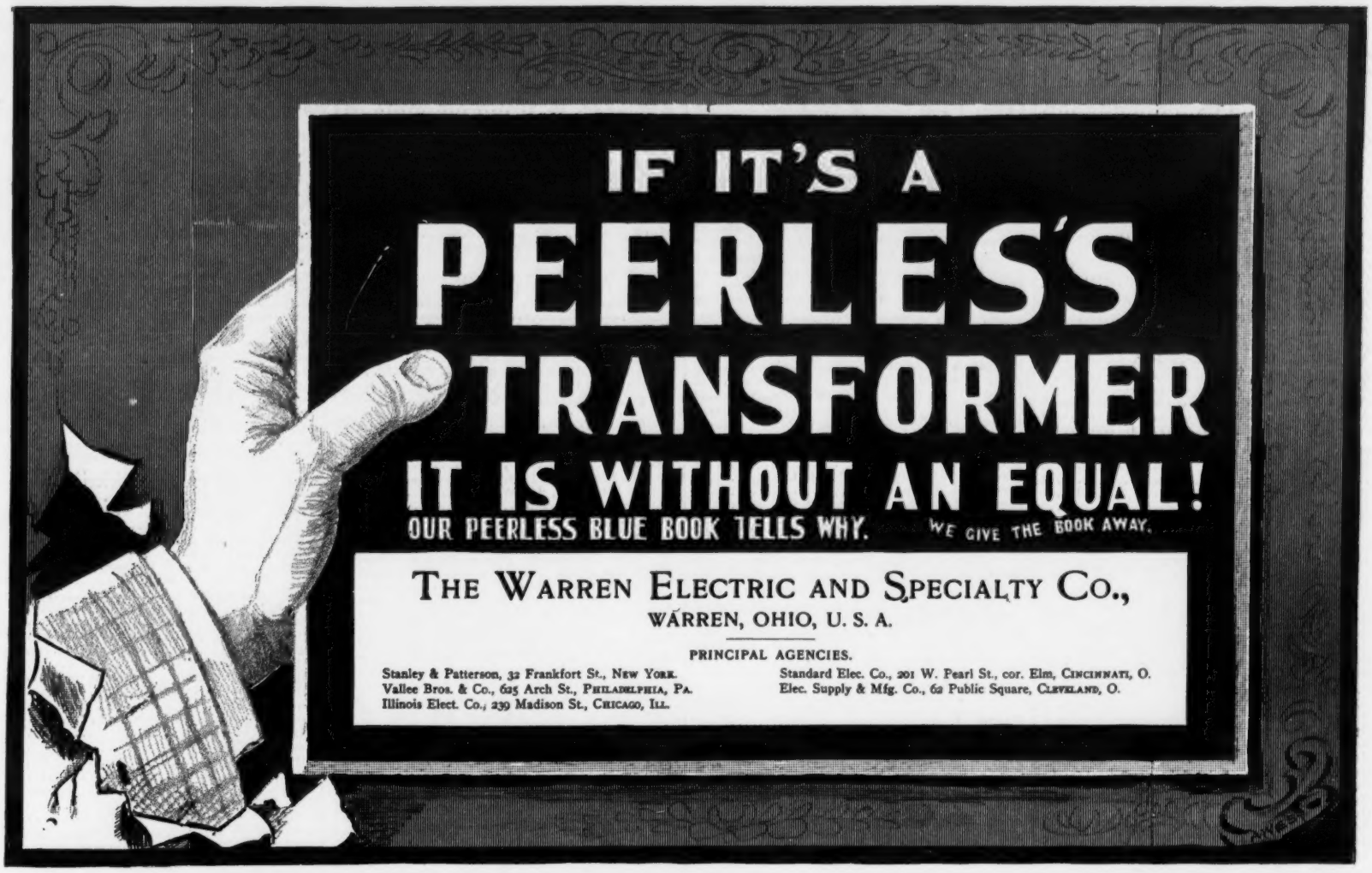
641,161. EARTHING DEVICE FOR ELECTRICAL CIRCUITS; L. J. Steele, London, England. App. filed June 17, 1899. Details of construction insuring an automatic connection of the circuit to earth if an abnormal current should at any time arise therein.

641,196. ELECTRIC LAMP.—C. Van Deventer, New York, N. Y. App. filed June 3, 1899. The lamp embodies a finger of refractory material, being a non-conductor cold, and a conductor hot, an electric conductor is embedded in the mass and forms a heating circuit from one end to the other; conductors are located on the exterior of the finger, so that a current will flow from the interior to the exterior of the finger.

641,214. THERMO-ELECTRICAL BUILDING BRICK OR BLOCK; J. Matthias, Stuttgart, Germany. App. filed Dec. 13, 1898. Thermo-electric elements are placed inside of hollow bricks and there subjected to a current of heated air.

641,220. APPARATUS FOR MAGNETICALLY SEPARATING ORES; C. Q. Payne, Stamford, Conn. App. filed Jan. 20, 1897. Consists broadly in improvements of means for controlling the position or direction of the lines of force within a magnetic field, so as to attain therein a very great extension of the range of magnetic intensity or effect.

641,224. ELECTRIC STREET INDICATOR; J. Y. Porter, Detroit, Mich. App. filed Dec. 17, 1896. Devices are attached to the trolley wire which are reversible to accommodate cars running in opposite directions; these devices operate indicators in the cars.


IF IT'S A
PEERLESS
TRANSFORMER
IT IS WITHOUT AN EQUAL!
OUR PEERLESS BLUE BOOK TELLS WHY.
WE GIVE THE BOOK AWAY.
THE WARREN ELECTRIC AND SPECIALTY CO.,
WARREN, OHIO, U. S. A.
PRINCIPAL AGENCIES.
Stanley & Patterson, 32 Frankfort St., NEW YORK.
Vallee Bros. & Co., 625 Arch St., PHILADELPHIA, PA.
Illinois Elect. Co., 239 Madison St., CHICAGO, ILL.
Standard Elec. Co., 201 W. Pearl St., cor. Elm, CINCINNATI, O.
Elec. Supply & Mfg. Co., 62 Public Square, CLEVELAND, O.

ROEBLING RUBBER WIRE

The WAGNER GLASS WORKS,

MANUFACTURERS OF

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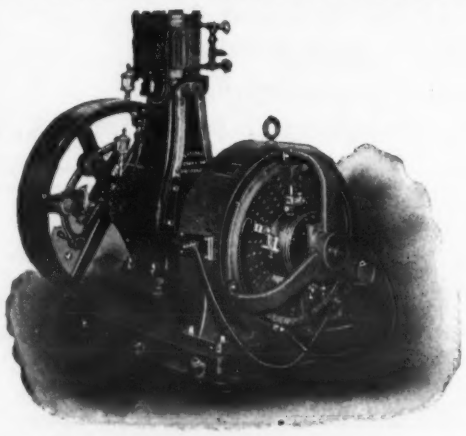

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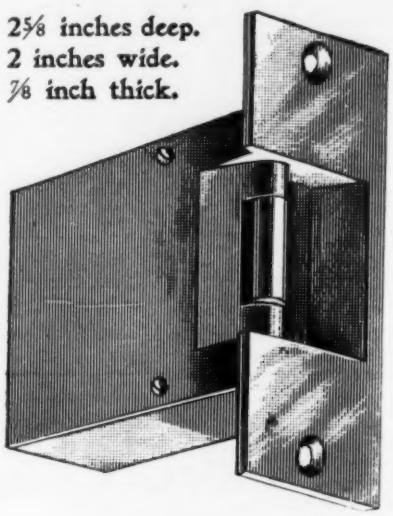

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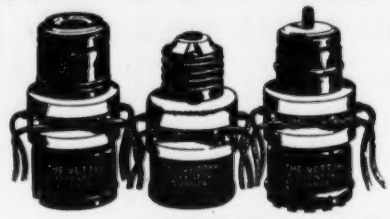

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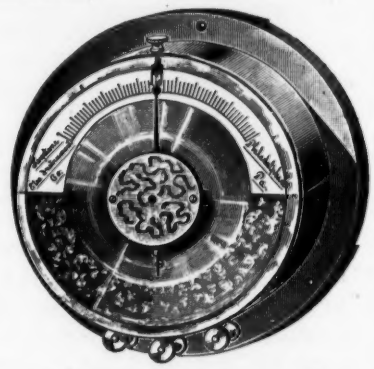

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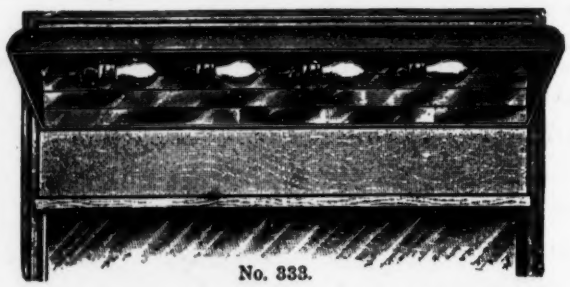

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